MODEL AIRPLANE NEWS

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THE WORLD'S PREMI[illegible] R/C MODELING MAGAZINE

48120

December 1995

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PAGE 70

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DECEMBER 1995 VOLUME 123, NUMBER 12

MODEL AIRPLANE NEWS

ON THE COVER: *strafing the cliffs in Utah, this mean-looking slope-scale Messerschmitt Me-109 (yes, it's a slope-soaring glider!) was built and flown by Brian Laird of Slope Scale (photo by Dave Garwood). For more information, turn to "Soar Utah" in this issue.*

ABOVE: *in stark contrast to the Unlimited racers, a beautiful WW II German Stuka dive-bomber takes to the air at Galveston '95 during the halftime break. To duplicate the sound of the full-size warbird in a dive, the Stuka had twin, air-driven sirens mounted above the landing gear.*

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EDITORIAL

TOM ATWOOD

NEW FLYING STYLES EMERGE

Pattern aircraft, old-timers, competition fun-fly airplanes, sport planes, rocket-ship electric sailplanes, thermal sniffers and other aircraft types all have markedly different flight styles. Yet, new and interesting flying techniques continue to break onto the modeling scene. Programmable radios have made much of this possible, but innovation in flight style has also sprung from new aircraft designs.

Many of us have used programmable radios to program in flaperons or aileron differential, coordinated rudder turns, or even roll and pitch compensation for knife-edge flight. But the possibilities go far beyond, and we believe we are seeing only the beginning of further innovation. Consider the "Waterfall"—a maneuver flown by Quique Somenzini at the '94 Tournament of Champions. His Extra 300S essentially somersaulted, wheels first, from a low-altitude, nose-up hover, back to a hover, with only a slight loss of altitude. How? The throttle is cut and a touch of down-elevator added to start the plane falling, tail first. As the plane begins a short tailslide, up-elevator is immediately added to pull the tail back and up (causing the wheels-first rotation). Within 10 to 20 degrees of rotation beyond the nose-down position, Quique adds full throttle and full down-elevator. When the engine is gunned, torque is an issue, so he simultaneously adds full right aileron (and, if needed, right rudder) to keep the plane from rolling leftward. When the nose is back up, throttle is cut and the plane is back in a hover position, ready for torque rolls or another Waterfall.

Tony Ayer hovers a Morris Hobbies SU-do-KHOI in preparation for low-speed aerobatics.

This novel maneuver reflects the use of what has been variously termed "programmable flight modes" or "multiple flight conditions"—a feature available on some programmable radios. By hitting a toggle, you can change *all* control-surface throws from those suitable for one flight mode, such as very slow-speed flight or hover, to those needed for another, such as high-speed flight or aerobatics. Programming for one flight mode may not be compatible with flight in another! Have any of our readers broken interesting ground in this area?

On the aircraft-design side, a new trend favors hovering and ultra-slow aerobatic flight of light, profile airplanes. Much like the competition fun-fly airplanes, these specialized profile aircraft have very light wing loadings, are easy to hover, nose-up, in little or no wind and can take off and land on small platforms. See our "Field & Bench Review" of the Morris Hobbies Gee-whiz-Bee and "Air Scoop" in this issue for a look at two more of these unusual aircraft.

After viewing some remarkable flight videos sold by Morris Hobbies, I called Walter Morris to find out more about this novel flying style. He noted that it is beneficial to fly in a hover, or in slow, near-hover flight, because the airplane is moving so slowly and at such a low altitude that it typically isn't damaged if you lose control and hit the ground. Walter says a responsive engine with a linear power curve and the right prop is key. Most people master the technique within about four flying sessions. Morris said his SU-do-KHOI model (see photo) will even do climbing, inverted flat spins! At this rate, what will the repertory of aerobatic maneuvers look like in two years?

'96 TOURNAMENT OF CHAMPIONS

Speaking of aerobatics, William G. Bennett has announced that the '96 Las Vegas International Tournament of Champions will be held on October 24 through 27 at the Las Vegas Radio Control Model Field. Total prize money has been increased to a whopping $151,000 (the largest aviation contest purse we are aware of—full scale or modeling), and the first-place winner will take home $30,000. Aircraft for the contest must be scaled after full-scale aerobatic aircraft, such as the Extra 300 or Sukhoi SU 26 (a 10-percent deviation is allowed). Engine size has been increased to 12ci, which allows enough power to fly even ½-scale aircraft!

As in past TOCs, pilots for the contest will be selected from the world's best R/C aerobatic competitors. The '96 event will doubtless continue the TOC's tradition as a trendsetter in R/C. For more information, call Steve Rojecki at (904) 939-2222.

OTHER NEWS

In this issue, two important articles on quieting your models are vital reading for those who are concerned with saving flying fields. Tore Paulsen addresses muffler design and more in "Sound Advice from Europe, Part 2," and Dave Gierke tests some of the quietest mufflers available in "Hey! Keep the Noise Down!" ■

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AIRWAVES

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IMAA-LEGAL?

I'm a newcomer to the sport of R/C flying, but I'm a longtime plane and car modeler. Every time I look through R/C magazines, I notice that models are often referred to as being "IMAA-legal." Could tell me what the IMAA is, and what are the basic requirements for a model to be IMAA-legal?

I love your magazine and have just become a subscriber; keep up the good work!

DARRIN PIONK
Clinton Township, MI

Darrin, IMAA refers to "International Miniature Aircraft Association." Basically, to be IMAA-legal, your model must have an 80-inch wingspan if it's a monoplane or 60-inch if it's a biplane, or it should be a true, 1/4-scale model. The emphasis is on powered scale and sport models—not gliders. The IMAA also recommends certain servo sizes and battery capacity, but they're only recommendations. There are no restrictions regarding engine size or number of engines, but most members use gas-powered engines such as the Quadras and Zenoahs.

The IMAA publishes a quarterly newsletter (High Flight), and membership costs $15 in the U.S., $20 in Canada and Mexico and $30 elsewhere. For more information, contact Don E. Vineyard, IMAA Secretary, 205 Silldale Rd., Salina, KS 67401; (913) 823-5569. GY

GEAR DRIVES VS. BELT DRIVES

With the proliferation of belt drives and gear drives for electrics, I'd like some advice on what the tradeoffs are.

JAMES ALBRIGHT
New York, NY

*James, we talked to a few of the "pros" in this area to get to the bottom of this interesting question. Gus Ogushwitz of USR&D Corp., publishers of AERO*COMP software, offered this background information:*

"As far as efficiency of the motor-prop system is concerned, there are two factors to consider: (1) motor loading due to the propellers and (2) motor loading due to friction in the belt-drive system.

"Regarding loading due to the props: imagine that one motor is driving just one small prop. The loading is relatively lighter, so the rpm are higher—often high enough to be operating above the peak of the efficiency curve. Now imagine that the same motor is driving two such props. The loading is now relatively heavier, so rpm are lower, and the motor may be operating more efficiently.

"Actually, the efficiency could be maximized by using a single, large-diameter prop of appropriate dimensions. Here, however, we are assuming that you are working with an airplane whose landing-gear height is restricting the propeller diameter so that use of a single larger prop is not possible.

"The other factor to consider is friction in the belt system. This comes in two flavors. First, bending a belt around a pulley takes effort, caused both by friction inside the belt and by friction between the belt and the pulley. This work must be supplied by the motor. Second, it takes a certain amount of tension to prevent the belt from floating off the pulley (even with toothed belts), and this tension puts a greater frictional load on one side of the bearings. If ball bearings are used, then fewer of the balls carry the load, and these balls have a higher dynamic friction. On the other hand, if bronze bushings are used, you will notice, after a few hours of operation, that the bushing is wearing out of round. (Years ago, most model airplane motors had bronze bushings. When we tried using small belt-drive systems, the bushing soon had to be replaced.)

"Both the belt-bending loads and the offset bearing loads require effort from the motor, and this reduces power

system efficiency. Such a reduction is particularly troublesome in electric systems, where we need all the power we can get!

"To summarize: if the only way to get two or more props to rotate is with a single motor, then belting may slightly raise the efficiency of the system. However, if you are thinking of using a belt to build a drive-reduction box, think again. A geared system is much more efficient, and you will end up with more thrust from your prop. (This is too bad, because belted systems are much easier to build!) In addition, the weight of a geared system may very well be less than the weight of a belted system, or at least no heavier."

We were curious: what is the efficiency loss? If the difference in this loss is too small for a modeler to measure, choosing one or the other type won't be critical. Manufacturers agreed that the quality of the gear or belt system's engineering can itself add or subtract a few percentage points, and this may be larger than the difference in efficiency between belt and gear systems of comparable quality.

A machinist's handbook noted that well-designed industrial gear drives of comparable simplicity will typically have an efficiency loss of 2 to 3 percent, and at least one higher-end, hobby gear-drive manufacturer conservatively assumes a loss of 5 percent (it's probably less). Another authoritative source had measured a range of middle-of-the-road gear and belt drives and found efficiency losses in the 5- to 7-percent range for gear systems and 5 to 11 percent for belt systems. The outside range for belt systems typically results from improperly tensioned belts (better to err on the loose side!). In any case, a well-engineered belt system will lose an additional 1 to 3 percent in efficiency compared with a geared system of comparable quality.

The great benefit of belt systems is ease of use combined with flexibility. For example, some belt drives allow easy swapping out and repositioning of pulleys for at-the-field changes in "gear" ratio. A pair of belts will be less efficient than shafting and gearing the props on a single-motor twin, but they may also weigh less. The great benefit of gear drives is small size and weight. Both types of reduction drives can produce surprising performance from less expensive motors. This is the big news: by gearing the prop down (and using a larger prop), it's often possible to achieve a better match between the airplane and the motor. It makes little difference whether the reduction drive is a gear or belt system.

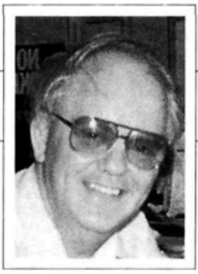
Here are some of the many sources of belt drives and gear drives:

- *AMP-AIR, (516) 253-2702—multi-motor geared drives for intermediate sport electrics;*
- *Astro Flight, (310) 821-6242—gear drives for Astro motors (all sizes);*
- *Hobby Lobby, (615) 373-1444—belt and gear drives (all sizes);*
- *Kress Jets, (914) 336-8149—belt drives, including custom, for small to medium aircraft;*
- *Modelair-Tech, (516) 979-1475—single- and multi-motor belt drives, medium to giant scale;*
- *Model Electronics, (206) 782-7458—gear drives, including lightweight boxes with extended carbon-fiber shafts for flying-wing applications.*

*Whichever reduction drive you use, how will you determine how the plane will fly with a given configuration? Two computer programs will give you some answers: AERO*COMP, available from USR&D, (908) 850-4131; and Electro Flight Design, available from Kress Jets. Hope this helps, James!* TA ■

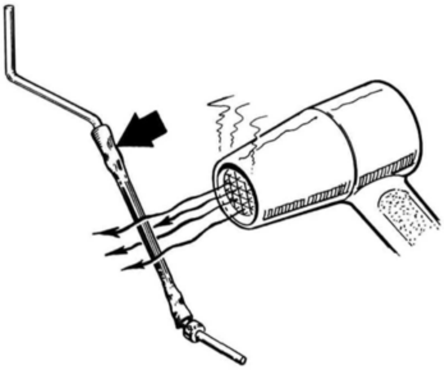
Errata: in Mike Billinton's review of the O.S. Max 32 SX-H heli engine (October 1995, *Model Airplane News*), we provided an incorrect address for a muffler produced by K&S of Japan. It's distributed in the U.S. by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511; fax (217) 355-0058.

HINTS & KINKS



JIM NEWMAN

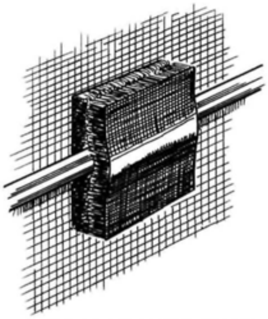
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



COLOR-COORDINATED GEAR WIRE

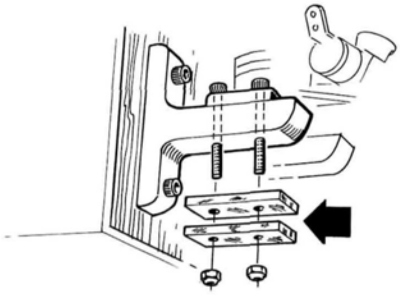
Because paint readily chips off those music-wire landing gears, cover the wires with colored heat-shrink tubing. It stays in place and never chips off.

Lawrence Jaconetta, Indian Orchard, MA



SECURE WIRING

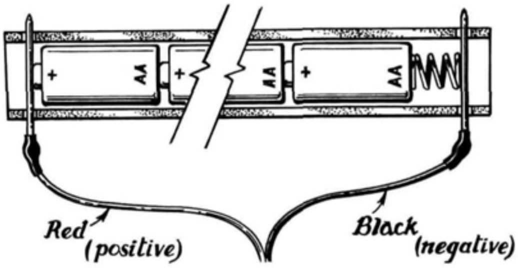
To prevent servo wires from being sucked into a jet model's ducted-fan, John glued Velcro®-brand fastener patches to the fuselage sides, then sandwiched the wires between the two pieces of Velcro®. ***John Burnett, APO***



SECURE NOSE WEIGHTS

Nose weights should be securely bolted to the firewall or bulkhead, not to fragile, insecure cowls. The engine mount must then be tapped to receive the extra-long screws. Now the lead bars can be retained under the mounts with self-locking nuts. Frank actually uses the self-adhesive lead strips from his hobby store.

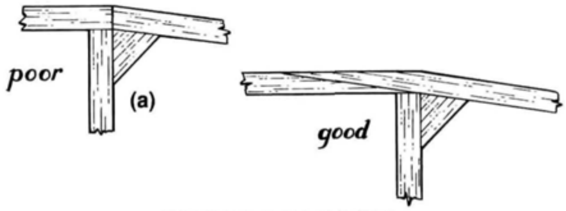
Frank Cunningham, Penryn, CA



LOOSE NI-CD CHARGING

AA-size Ni-Cds will fit inside ¾-inch (19mm) PVC plumbing pipe, so cross-drill the ends of the pipe for the two sixpenny finishing nails to which the charger leads are soldered. The spring keeps the cells in contact with one another while the leads go to the appropriate charger.

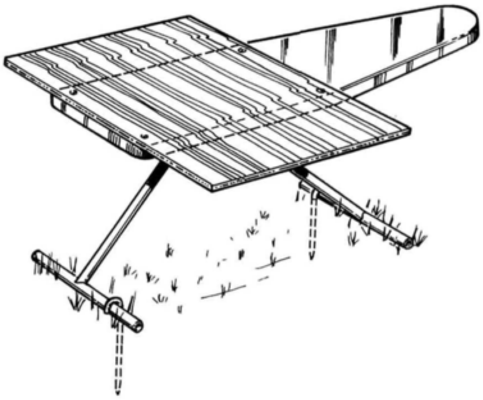
Steve Fields, Penndel, PA



SCARF JOINTING

On many stick-built models, particularly at the fuselage and the trailing edge of the wing, you will find this type of poor jointing (a). A stronger and better method is to make a scarf joint as shown. It eliminates the need to butt-glue the sticks, and it can be used in many areas of the structure, such as the center of the wing spars.

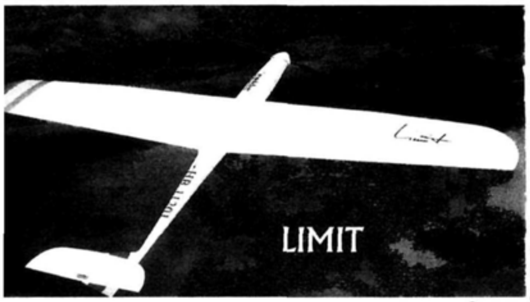
Cliff Niesen, Crescent City, CA



EZ FIELD BENCH

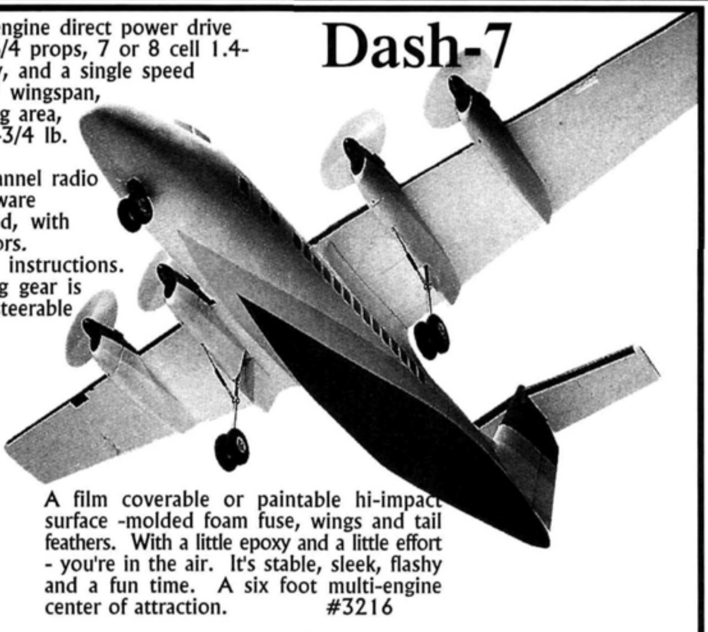
To make a height-adjustable field bench, screw a sheet of plywood to an old ironing board. Make some spikes from steel reinforcing rod so that you can firmly anchor the feet, or the bench will surely blow over.

G.R. Silbersdorff, Wyckoff, NJ



DASH-7 A 4-engine direct power drive electric, using 6/4 props, 7 or 8 cell 1.4-1.8MAh battery, and a single speed controller. 71" wingspan, 720 sq. in. wing area, flying weight 5-3/4 lb.

Four to five channel radio required. Hardware package included, with motor connectors. Comprehensive instructions. Optional landing gear is available with steerable nose wheel.



A film coverable or paintable hi-impact surface -molded foam fuse, wings and tail feathers. With a little epoxy and a little effort - you're in the air. It's stable, sleek, flashy and a fun time. A six foot multi-engine center of attraction. #3216

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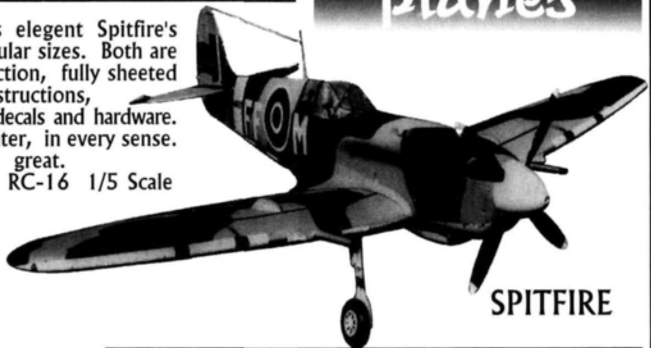
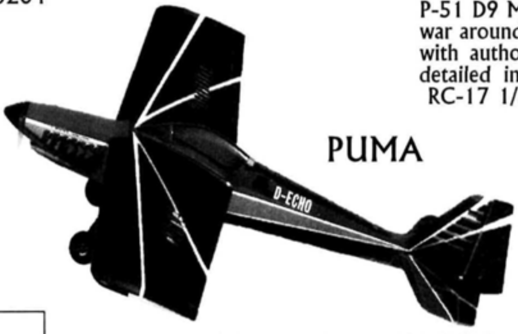


CO YMF 3-5 The Golden Era of aviation will come alive 1 this smooth gentle flying biplane. Available in popular sizes, both kits include wood construction,full size ns,detailed instructions with iso-metric drawings.
RC-4 1/6 Scale, RC-12 1/5 Scale

SKYFLEX 2000 A no nonsense simple way to learn to fly R/C. Motor speed gives you the up and down and the stick on the radio gives you the left and right. Motor, drive, prop already in place. Install the radio gear and assemble the frame, place the sail ontothe frame, and with a couple of adjustments you're ready to go. #3204

P-51 D9 MUSTANG The WWII fighter that turned the air war around. It's fast agile and gentle, answers to the stick with authority. All wood construction, full sized plans, detailed instruction book, hardwarpackage, decals.
RC-17 1/5 Scale, RC-18 1/6 Scale

IA 40 It's agile, it's gentle and it's the ect next plane. Kit includes a durable ABS posite Plura fuselage, pre-sheeted foam wings 1 factory set dihederal, full hardware pack- motor mount, fuel tank, GRP main gear 1 wheels. Optional tri-gear setup.
164



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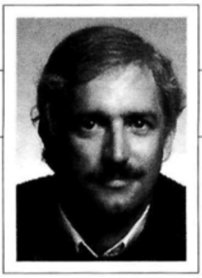
DAVE PATRICK



REALLY (REALLY!) FLAT SPINS

SOME TIME AGO, I discussed spins and flat spins. Since then, I've learned more about these maneuvers. I would like to pass on a couple of the tricks I've picked up.

In the early days of aviation, the spin was to be avoided at all costs. Even today, it has been the downfall of many pilots, yet in modern aerobatics, it's a common sight. So, why the fear? During a spin, the aircraft stalls and autorotates downward, and the controls are almost useless; remember, I said "almost." When, or if, the spin is stopped, the nose of the aircraft ends up pointed almost straight down. This is not something you want to start close to the ground! The key to avoiding an inadvertent spin is not to stall.

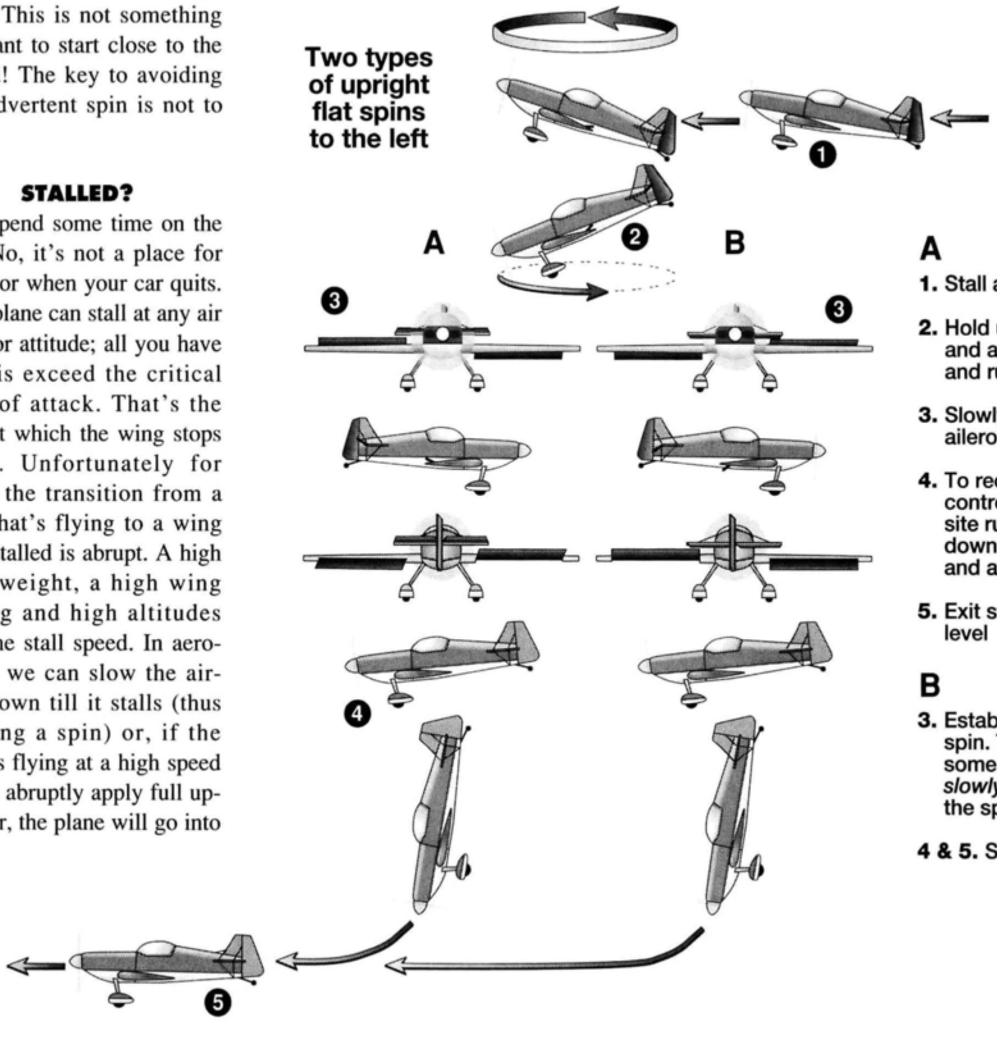
STALLED?

Let's spend some time on the stall. No, it's not a place for horses or when your car quits. An airplane can stall at any air speed or attitude; all you have to do is exceed the critical angle of attack. That's the point at which the wing stops flying. Unfortunately for pilots, the transition from a wing that's flying to a wing that's stalled is abrupt. A high gross weight, a high wing loading and high altitudes raise the stall speed. In aerobatics, we can slow the aircraft down till it stalls (thus allowing a spin) or, if the plane is flying at a high speed and we abruptly apply full up-elevator, the plane will go into an accelerated high-speed stall. This usually results in a left snap and a spin. In either case, plenty of recovery altitude is necessary.

SPIN BASICS

The garden-variety spin is started and finished in the upright position. From level flight, throttle back and, as the aircraft slows down, maintain altitude by adding up-elevator. Finally, you reach a point at which the stall angle is achieved, and the plane will suddenly "fall" (it has stalled). At this point, maintain full up-elevator, and apply full aileron and rudder in the direction of the spin. The plane should descend slowly, rotating rapidly around its center of gravity without increasing its descent speed. If the plane won't spin (some designs are made that way), move the balance point farther aft, and increase the elevator throw. Be very careful when you make these adjustments, because you can dramatically affect the planes's overall stability and its ability to recover from a spin. Always make one small adjustment at a time.

OK, you've gotten your plane to spin; to recover, just let go of the con-



A

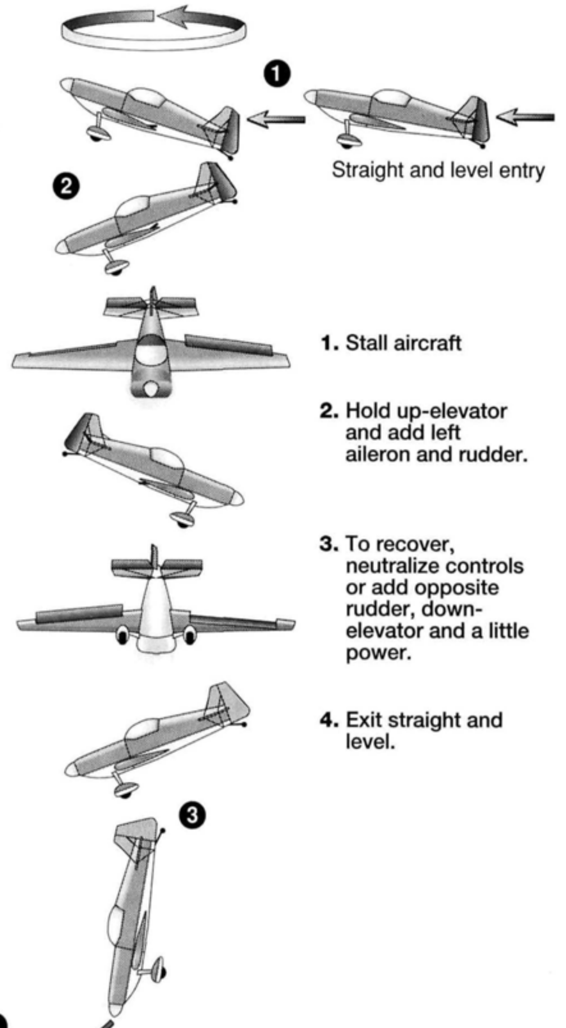
1. Stall aircraft
2. Hold up-elevator, and add left-aileron and rudder.
3. Slowly add opposite aileron.
4. To recover, neutralize controls or add opposite rudder, down-elevator and a little power.
5. Exit straight and level

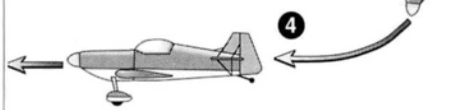
B

3. Establish a regular spin. Then add in some down elevator *slowly* to really flatten the spin out.

4 & 5. Same as A

Typical spin to the left





trols. If this doesn't work, add opposite rudder, down-elevator and a little power. If that doesn't do it... well... punt?

BUT I WANTED A FLAT SPIN

• Flat spin. This maneuver can look great, but it requires an aircraft that's capable of performing flat spins. Some models can't do it because they have too much stability designed into them. Most of the Goldberg Models (CGM)* Scale Aerobatic Series can spin, after they've been set up properly.

• Upright flat spin. Enter the flat spin as you would a regular spin. After the spin has been established, try adding down-elevator *slowly*. I've done this with the new CGM 1.20 Bucker, and it's a spectacular flat-type spin.

• Inverted flat spin. This is a real favorite around here. Roll inverted, throttle back to idle, and use down-elevator to maintain altitude until the aircraft stalls. Then apply full down-elevator, full right rudder and left aileron. After the spin has been established, slowly add right aileron, and the plane should go flat. Recovery is the same: neutralize the controls, or add opposite rudder, up-elevator and a little power.

Now, to get most planes to flat spin, it takes a lot of control throw and an aft balance point, so be very careful. As I said before, increase throw, and move the CG aft in small amounts.

Have fun, and good luck!

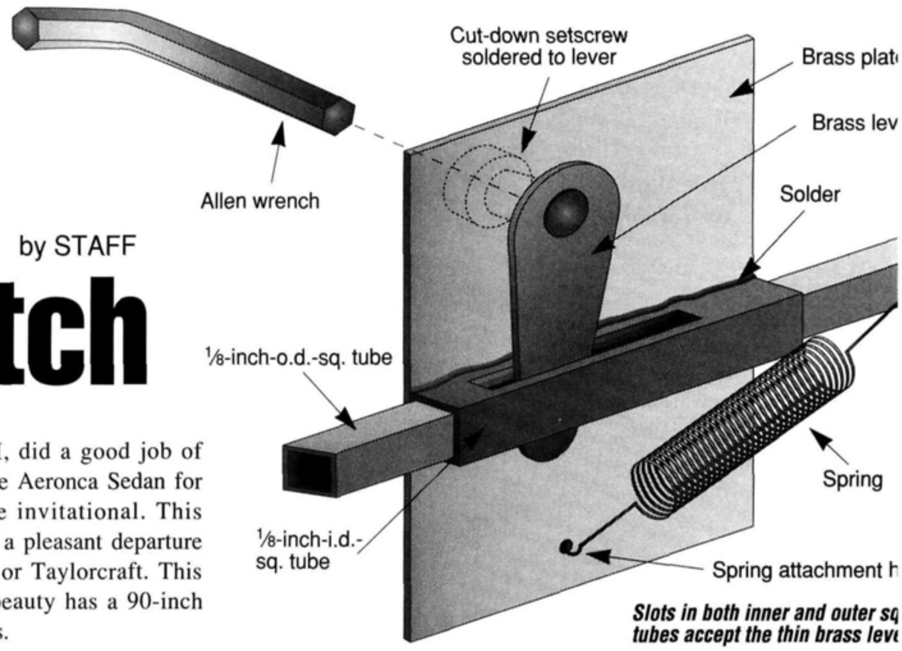
**Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

Scale appearance and function

Make a Model Door Latch

by STAFF

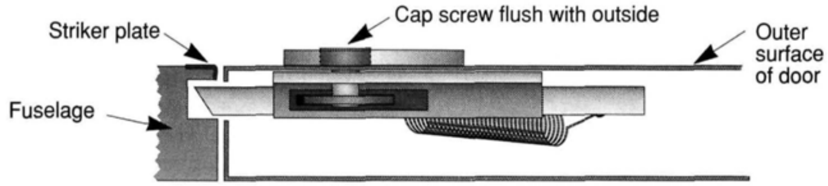
SPRING MECHANISM DETAIL



Slots in both inner and outer sq tubes accept the thin brass leve

Steve Sauger of Troy, MI, did a good job of scratch-building a ⅕-scale Aeronca Sedan for the 1995 Top Gun scale invitational. This fabric-covered light aircraft is a pleasant departure from the run-of-the-mill Cub or Taylorcraft. This O.S.* .90 4-stroke-powered beauty has a 90-inch wingspan and weighs 15 pounds.

TOP VIEW OF MECHANISM PLACEMENT WITHIN CABIN DOOR

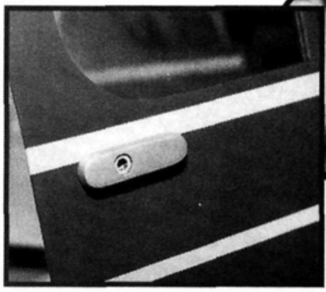


SCALE LOOKS AND FUNCTION

Looking inside, you can see that the scale effort didn't stop at the cabin door. In fact, the interior of Steve's model is fully detailed, and the cabin door itself is completely functional. He included a slide bolt and a striker plate similar to those on the full-size Sedan. Steve's technique can easily be adapted to a variety of other scale cabin planes.

Check out the photos and illustrations, and see what you can come up with for your next scale masterpiece.

When the cabin door is open, you can see that it is detailed with padding, trim and fabric on the lower portion. The slide bolt is barely visible. For an uncompromising scale appearance, no latch mechanism is visible.



Notice the small cap-head screw in the middle of the door-latch handle. Steve can quickly and easily open and close the door with an Allen wrench.

On the T-table at Top Gun '95, Steve Sauger's Aeronca Sedan is a beautifully executed civilian classic.

With the door closed, the overall appearance of the Sedan is very convincing.

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Big Pussycat

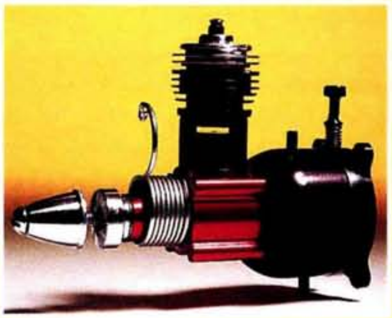
If you believe, as I do, that larger models are more forgiving because of their smooth, predictable control response, Thunder Tiger's new 72-inch-wingspan Tiger Trainer 60T should interest you considerably. Built up much like a conventional wooden kit, the 60T comes covered in bright film, just as you see it here, and it includes a tank, a spinner, wheels, a motor mount, pushrods and a hardware package. At a flying weight of 8 pounds and a wing area of 915 square inches, the Tiger Trainer 60T has a wing loading of 20.2 ounces per square foot. That figure spells one thing—*forgiving*! Designed for .60 2-stroke engines, the big 60T should prove to be a very gentle trainer. Contact Thunder Tiger USA, 2430 Lacy Lane #120, Carrollton, TX 75006; (214) 243-8238; fax (214) 243-8255.

Aerial Contortionist

Powered by two MVVS .21s or similar high-performance 2-strokes, the Morris Hobbies Pinwheel is a true aerial contortionist. It's capable of hovering figure-8s, knife-edge loops and, with the Morris engine mixer (which makes the plane capable of dropping the left engine to an idle when full left rudder is applied or vice versa), unbelievable in-flight pinwheels and "supersonic" flat spins. Imagine a climbing inverted flat spin with one engine at full throttle and the other at idle; that's what the Pinwheel can do. The Morris Mixer sets up the engines to throttle down at any point you choose—½, ¼, full throw, or anything in between. The mixer can be switched off or reversed in flight to make things even more interesting. The Pinwheel costs $109.95, and the mixer costs $65; the combo can be bought for $169.95. It's also available with two MVVS .21s and tuned silencers for $379.95. Contact Morris Hobbies, 4200 A Leghorn Dr., Louisville, KY 40218; (800) 826-6054.

Gotcha

When I first saw this photo, for a moment I, too, thought it was a full-scale 182. This beautifully detailed Cessna 182 is the first in Global's new Global EZ line of ARF models. From the airfoil-shaped wing struts to the panel lines and rivets, this new 6-foot-span Skylane delivers scale appearance in every way. Even the scale cockpit interior is supplied. The realism, however, goes beyond form and includes features of function—working flaps, to be specific! All the building, sanding, covering and painting has been done for you. Rumor has it that the workmanship is outstanding. Specifications: wingspan—72 inches; wing area—725 square inches; flying weight—8 pounds; wing loading—25½ ounces per square foot; engine—.60 to .65 2-stroke. We'll have a full "Field & Bench" on this beauty as soon as it becomes available. Contact Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.



For years, the ½A race pros have been modifying the Cox Black Widow, extracting performance that far exceeds anything obtainable from a stock factory example. Now Cox has taken the best of these performance-"tweaking" secrets from top racers, thrown in a few tricks of their own and incorporated all of it in the new Venom.

Cox VENOM Race-Ready

The Venom features an anodized crankcase and a heavy-duty Killer Bee crankshaft, which is "loose-fitted" for ultra-low drag. Other proven features are Cox's radically ported Tee Dee sleeve and lightweight piston, both of which are taper-ground for high-rpm race conditions. The fuel tank and the zero-drag spring starter were borrowed from the Standard Black Widow 0.49. For more information, contact Cox Products Inc., P.O. Box 4800, Corona, CA 91720-2004; (909) 278-1282; fax (909) 278-2981.

Rugged Razorback

The P-47D Thunderbolt—icon of the European theater—now joins Top Flight's Gold Edition Warbird Series. The nostalgic Razorback has been brought to life in ⅐-scale with this new, highly detailed, all-balsa kit. Because of the CAD construction techniques, the Thunderbolt's interlocking parts go together quickly and accurately; photo-illustrated instructions and full-size rolled plans help to smooth the assembly process further. The most exciting feature of this warbird is probably the airfoil, which was designed by University of Illinois Low-Speed Airfoil Test Program founder and internationally recognized expert Dr. Michael Selig. As a result, the P-47 offers excellent slow-speed-stall resistance coupled with superb handling throughout its envelope. Specifications: wingspan—63 inches; wing area—713 square inches; weight—8 to 10 pounds; engine requirements—.61 to .91 2-stroke or .91 to 1.20 4-stroke. For more information, contact Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104.

The Needle and the Rose

Ever wonder where those beautifully embroidered hats and jackets that some modelers sport come from? At IMAA scale meets across the east coast, the name Melrose is becoming a familiar synonym for quality. Melvin and Rose DeBose of Wilmington, NC, are the reasons so many modelers are sporting custom embroidery. A sample of their work is modeled here by Hilary, Air Age's breathtaking production assistant. The quality, huge choice of colors and hangar full of aircraft types from which to choose make it easy to get exactly what you want. Silver P-51 with yellow-and-black checkerboard nose?—no problem. How about an Olive Drab B-25 or P-38?—you're covered. Pink Sukhoi?—roger that, comrade! Rose, with her computer-controlled embroidery machine can do you up in sharp, crisp fashion. If you ever wanted a personal piece of aviation history to wear, give Rose and Mel a call; start a fashion trend in your club! The Melrose Co., 130 Pinecrest Pkwy., Wilmington, NC 28401; (910) 763-4781.

People like Amelia Earhart and Wiley Post pushed the edge of aviation limits with the Lockheed Vega. I think it was in this craft that consummate wiseman Will Rogers took a fateful ride on the frontier. Why it has taken till now for our industry to kit this icon of aviation history is a good question. The long-awaited answer, however, is very good news. The project was taken up by Ikon N'West, and they now offer a complete all-wood kit. Anyone who's even vaguely familiar with Ikon N'West's work knows their products are top-drawer. This 105-inch-wingspan, ⅕-scale design features hand-cut parts made of carefully selected wood and is completely sheeted like the full-scale are. Its power requirement is a 1.20 4-stroke and, with 1,730 square inches of wing area, the wing loading comes in at a very docile 25 ounces per square foot. For more information, contact Ikon N'West, P.O. Box 306, Post Falls, ID 83854; (208) 773-9001. To order, call (800) 327-7198.

Flying the Frontier

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1995. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

GORGEOUS GOONEY BIRD

Edmundo Carmona of Pachuca, Hidalgo, Mexico, recently built this DC-3 model from a Royal kit. The 10-pound plane has functional retractable landing gear and flaps and is powered by two O.S. .46 pump engines. Edmundo used Du Pont acrylic enamel to create the early Aeromexico Airlines markings.

RESISTANCE FIGHTER

George Orfanos of Aspra Spitia, Beotie, Greece, designed and built this model of the Morane-Saulnier 406—a French WW II fighter that had a rear-placed cockpit, a retractable radiator, a belly antenna and positively cambered main wheels. The semi-scale, 86.5-inch-span model weighs 16 pounds and has oversize wheels to "cope with the un-trimmed grass of the flying field, where sheep are the natural lawnmowers."

BUBBLETOP PIPER

Dan Santich of Pinnacle, NC, used Wylam drawings and data from Piper to design this ⅓-scale Skycycle. The full-size prototype craft was built out of a P-47's disposable drop tank and the wings of a Piper Tricycle; the model has a fiberglass fuselage and balsa wings. Dan says that the 80-inch-span model "flies like a trainer."

MARINE MAELSTROM

Scott MacCready of DuBois, PA, modified this Douglas SBD-1 Dauntless from a Bob Holman SBD-5 kit. The model has operational flaps, dive brakes and retracts and is powered by a Super Tiger .75. Scott created the 1939 U.S. Marines paint scheme using automotive bumper paint and Black Baron epoxy over silkspan and dope.

FLYING HISTORY

Jakob Jonsson of Reykjavik, Iceland, built this ¼-scale Avro 504K to celebrate 75 years of aviation in Iceland. Jakob says that a full-size Avro took off on September 3, 1919, at 5 o'clock and that his model took off from the same spot on the same date 75 years later.

PILOT PROJECTS

A PAIR OF PUSHERS

Dan Anderson of Salem, OR, built these Sport FA-18 Hornets from *Model Airplane News* plans. He modified each with built-up, sheeted, flying stabilizers instead of elevators; leading-edge extensions for realism and improved slow-speed handling; and a Sig WW II canopy for a more streamlined look. Powered by O.S. .32 engines, the models perform blistering rolls and have excellent slow-speed handling.

ELECTRIC 'CAT

This stand-off-scale Grumman F6F-3 Hellcat was scratch-built by Richard C. Fleming of Olivet, MI. He says that, powered by a geared Astro 40 motor on 20 cells, it will almost jump off a grass runway in less than 30 feet. Richard covered the Hellcat with white Micafilm and finished it with Floquil model railroad paint. The 58-inch-span model weighs 104 ounces ready to fly.

TWIST THE NIGHT AWAY

Andris Freimanis of Kincardine, Ontario, Canada, scratch-built this Imperial Knight Twister from *Model Airplane News* plans. The 16-pound craft is powered by an O.S. BGX 3500 with a Jim Cline fuel regulator and a Slimline muffler. He covered the model with 21st Century fabric with K&B epoxy on the fiberglass parts. Andris says: "The design is excellent, and the model's flying capabilities are spirited yet not at all as unforgiving as I had expected." Equipped with a Simple Smoke pump, the model must really look pretty in the air.

CHECK YOUR SIX

Tom Sentfen—a firefighter from Middletown, OH—built this F-14 from a Great Planes kit. It has retracts and a MonoKote finish with Presto Graphics for panel lines. The $7\frac{1}{2}$-pound model is powered by a YS 60 engine with a tuned pipe running down the tunnel on the underside. Tom says that the jet is "a very groovy flier."

HOWLING FIGHTER

This Focke-Wulf 190A-5 is the handiwork of Capt. Mike Youngling of Norman, OK. He scratch-built the 80-inch-span, 19-pound model using Bob Holman plans, and he equipped it with Gene Barton retracts and split flaps, which make landings very slow. Mike says that the model flies very well on an ST 3000.

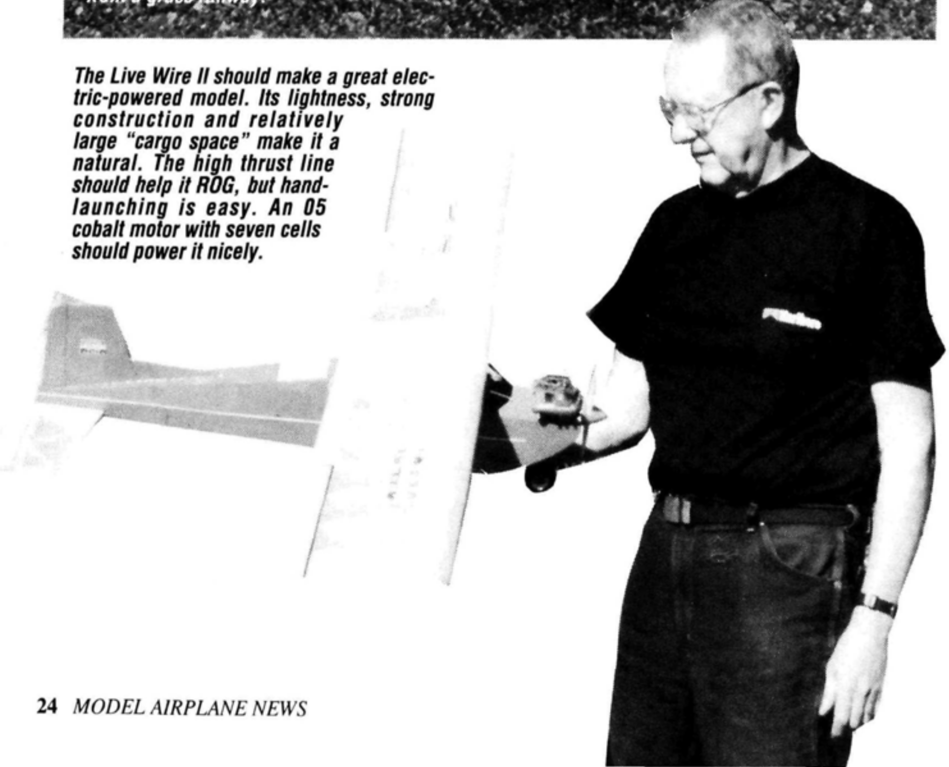
CONSTRUCTION

Live Wire II

by GEORGE WILSON

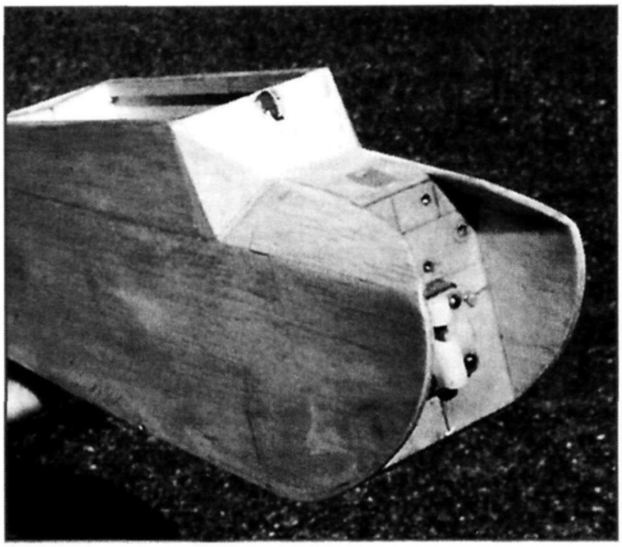
The almost finished model. The aileron outlines and a fuselage stripe were added later. The O.S.* .10 engine flies the Live Wire II very handily—including takeoffs from a grass runway.

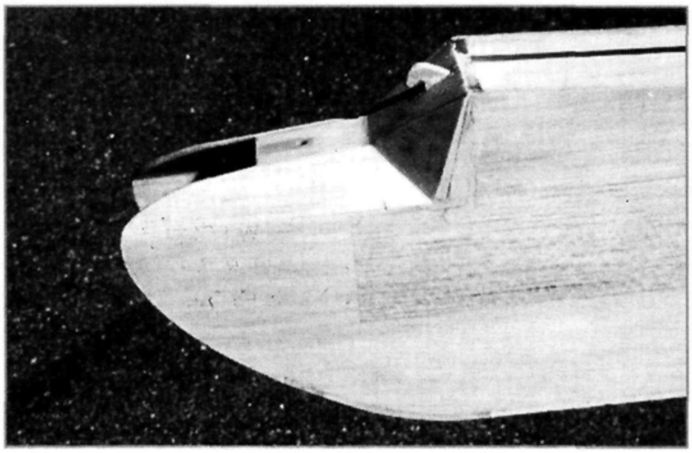
A great flying .10-size update of Pappy deBolt's classic



The Live Wire II should make a great electric-powered model. Its lightness, strong construction and relatively large "cargo space" make it a natural. The high thrust line should help it ROG, but hand-launching is easy. An 05 cobalt motor with seven cells should power it nicely.

THIS UPDATED, simplified version of Hal deBolt's Live Wire trainer is a great project for the novice who has passed the ARF stage and wants a model that is not a lookalike trainer. Additionally, it is easy and inexpensive to build and operate. It uses a .10 engine, it flies well, and it does not require a lot of space to be stored or transported to the field. A gallon of fuel should fly it almost all season!





The windshield area is built simply. The construction notes that come with the plan tell you how. The hook-type front-wing hold-down is an improvement on the original's simple dowel. Many Live Wires lost their wings in flight because of the hold-down dowel.

The forward end of the fuselage just before covering. The eight blind nuts are in place, and the control holes and fuel hole have been drilled before assembly.

The new Live Wire is similar to deBolt's original only in general appearance and force setup. The original was a tail-dragger and used escapement control of rudder and, possibly, throttle and/or elevator. The current version has tricycle gear and a 3-channel proportional radio.

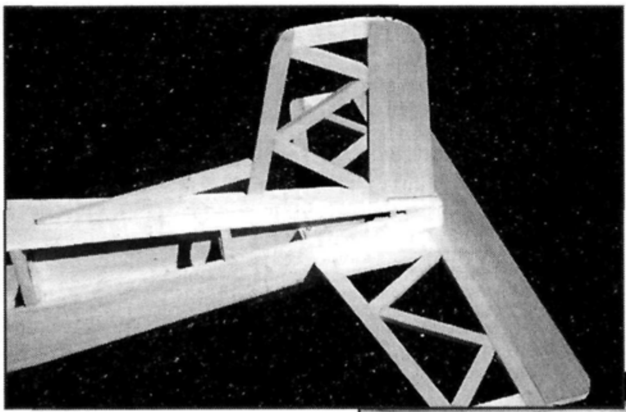
The construction techniques have been updated. Rather than retaining its original characteristics, the tail surfaces and airfoils have been changed to make it a more tranquil trainer. Incidentally, I hope that "Pappy" deBolt still accepts my "plagiarism" as a sincere compliment.

FLIGHT PERFORMANCE

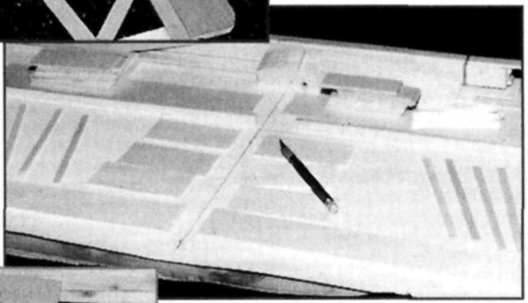
The model flies very well. As you'd expect a trainer with a flat-bottom wing to do, it tends to zoom a bit at the end of a dive. With its undercambered wingtips, stalls are no problem at high or low speeds.

Hans Sagamuehl made the first test flight for me. He planned to hand-launch it, but after feeling the thrust, he elected to ROG, and it did—handily. It hasn't been hand-launched yet! A minute into the first flight, he handed me the radio and said that his services were no longer needed; indeed, they were not!

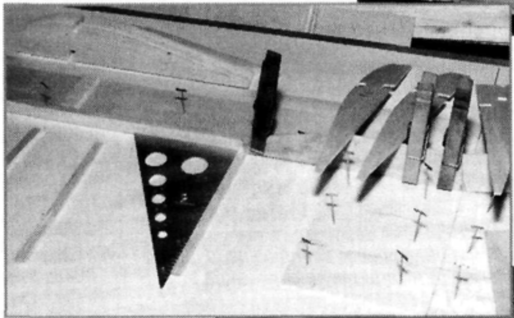
Live Wire II is a pussycat to fly. The original 8x3 wooden propeller (an antique that's about 25 years old) was soon broken, and we tried a 7x3 plastic prop, but soon changed to an 8x4.



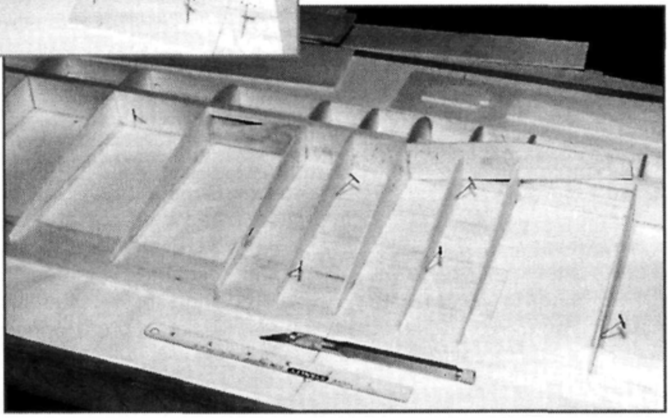
The roughly finished tail feathers have been trial-fit to the fuselage. The flat diagonal structure of the tail surfaces is a favorite of the designer. The surfaces resist warping and they're light and strong.



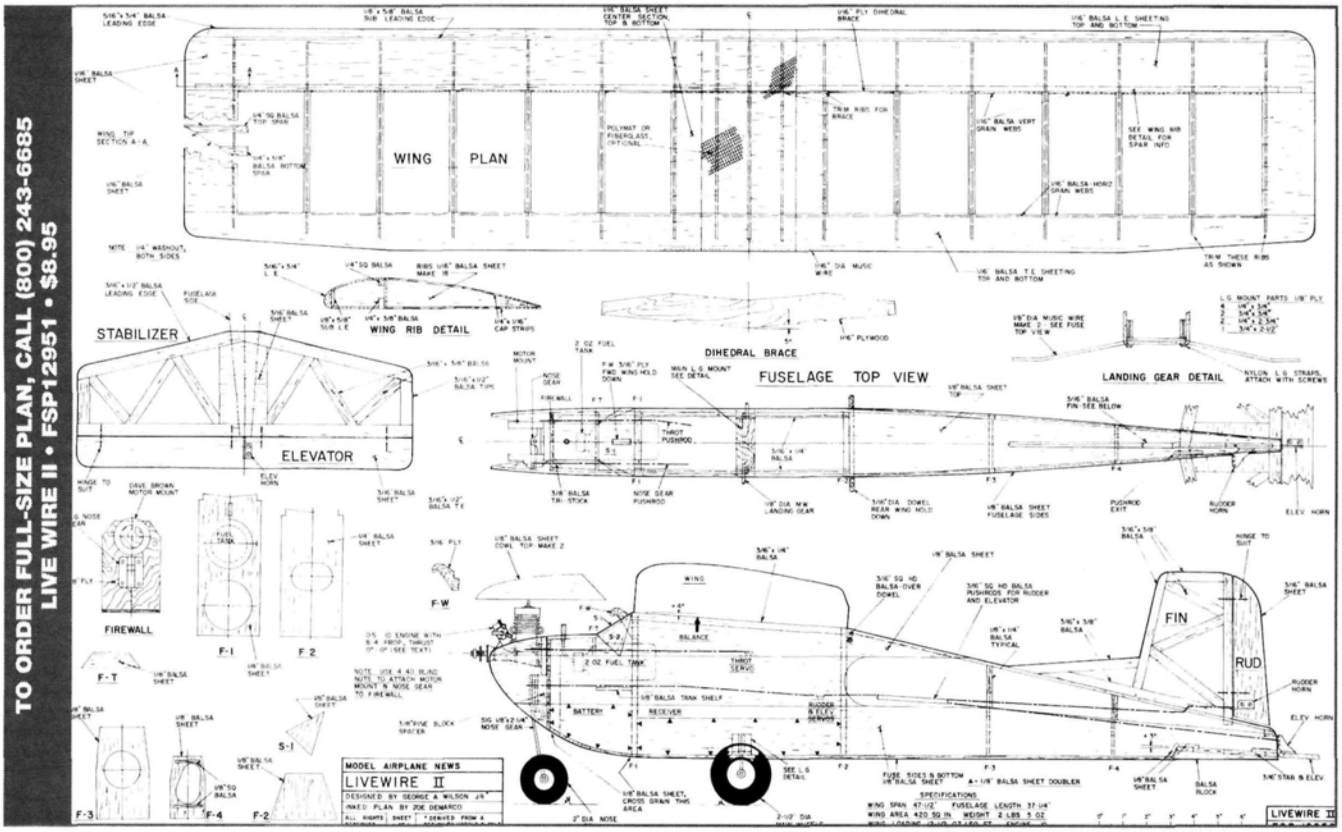
The "kitted" wing parts on the plan before being assembled. Kitting makes scratch-building easy and helps you when you study the plan before starting construction.

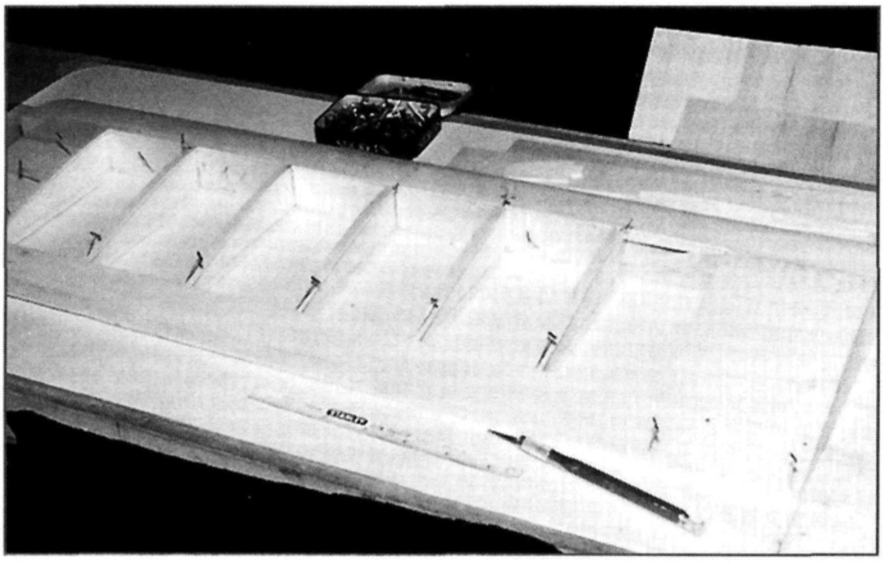


The start of wing construction. The square helps to make things true; don't build without one!

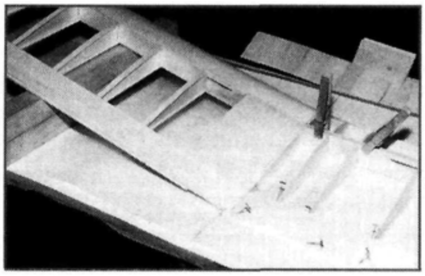


The wing center section with the bottom sheeting, spars, subleading edge, webbing and dihedral brace in place.





The wing sheeting in place on the left wing. The trailing edge is shimmed up to give 1/4 inch of washout at the wingtip. This side was later tilted off the board to form the dihedral angle.



The dihedral angle is formed by tilting the "finished" wing using a square block. Note the washout shim (this one is continuous, but several short pieces also work well). The center rib on the right wing was installed after the dihedral brace had been fitted and cemented into place.

SPECIFICATIONS

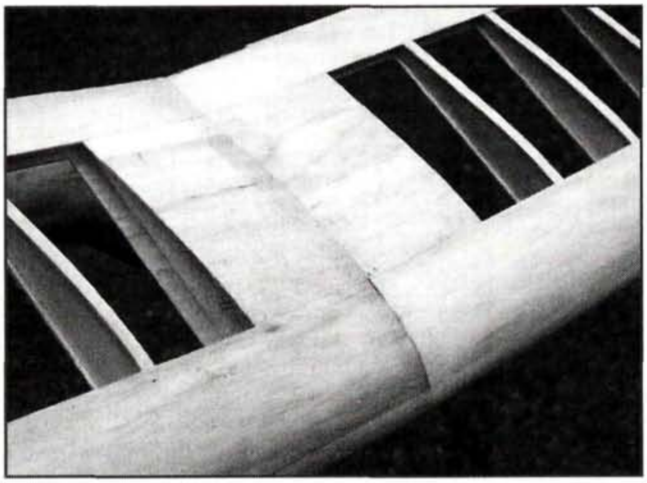
Name	Live Wire II
Type	old-timer replica
Wingspan	47.5 in.
Airfoil	flat-bottom
Weight	2.27 lb.
Wing area	420 sq. in.
Wing loading	12.5 oz./sq. ft.
Radio req'd	3 channels (throttle, rudder, elevator)
Engine req'd.	.10 2-stroke

Comments: this is a replica of the original Live Wire designed by Hal deBolt. Construction is of balsa and plywood, and the original tail-dragger design has been changed to a trike configuration. Because of its easy flight characteristics and simple construction, the Live Wire II makes a great trainer.

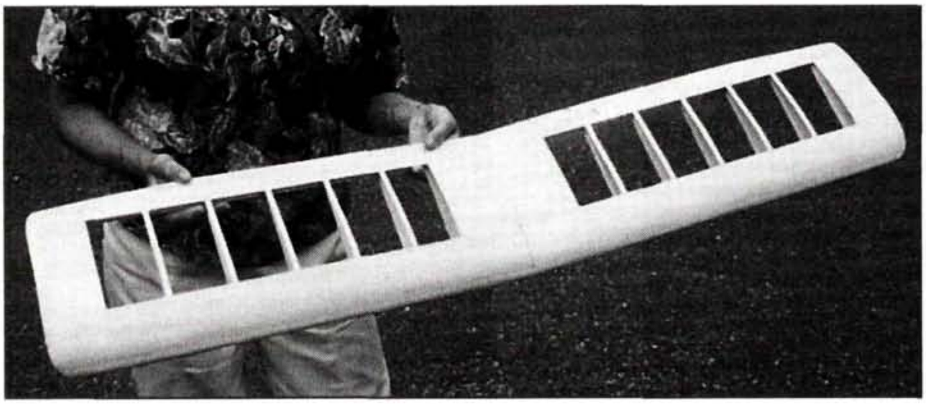
When the deBolt Live Wires were in vogue, R/C models with .10 engines would seldom rise off ground (ROG) because of their weight. The Live Wire trainer was set up to ROG: note the incidence in the wing and elevator. Rotation for takeoff was hardly necessary. And the current lightweight version takes off from our grass field with ease. Admittedly, our "field marshal" does keep the grass well-mowed. The high thrust line helps to counteract the upward vertical rotation caused by the high wing and keeps the propeller out of the grass. Note that when flying level, the thrust line is negative because of the wing/elevator incidences. Again, this helps offset the wing drag.

Make scratch-building easy by "kitting" the parts before you start building. Select the balsa as you go; my scrap and storage

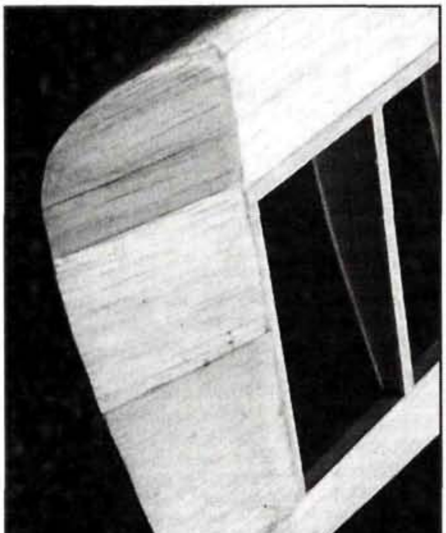
Because of its easy flight characteristics and simple construction, the Live Wire II makes a great trainer.



The finished wing center section. A 1/16-inch wire is inset at the center of the trailing edge to strengthen the area where the wing hold-down bands will go. Covered with Coverite* Micafilm, this model did not use a strengthening covering at the wing center. Light fiberglass is OK, but the author recommends Polymat Cloth from Ace R/C* because it's easy to handle and can be attached with dope.



The finished wing—light and strong. The blunt leading edge helps make the Live Wire's flight characteristics gentle (including stalls).



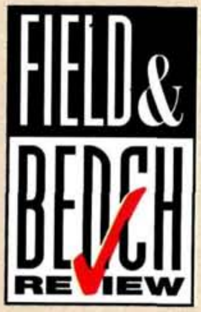
The under-cambered wingtip is easy to build and appears to add tip lift that helps to delay tip stalls. The model does not "fall off" at low speeds—typically, on landing approach.

bins provided balsa of most of the appropriate hardnesses; a trip to the hobby shop met my other needs, including for the hardware items.

Do not assume the edges of your balsa sheets are straight. Check them with a straightedge, and trim them as necessary. If you're a first-time scratch-builder, there's nothing wrong with asking an experienced builder for help. Construction notes are brief and are included with the plan. If you take the time to really study the plan, you'll find the Live Wire II easy to build. Think ahead as you build; for example, be sure to cut the holes in the formers and ribs.

This 3-channel trainer/fun flier is easy to build, inexpensive and a real fuel saver. It will turn on the nostalgia in all of your flying buddies who cut their modeling teeth in the '50s and '60s. There were lots of good times in those days with the whole Live Wire series!

**Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■



THE EINDECKER was a WW I mid-wing observation monoplane that was designed and manufactured by Anthony Fokker. This marginally successful aircraft was the first to use a brazed, tubular-steel frame. It incorporated wing warping instead of ailerons for lateral control, and it had full-flying tail surfaces. Fokker's claim to fame was as an innovator and a salesman, not as an engineer. The Allies weren't interested in Fokker's plane; Germany was.

Fokker had incorporated a synchronized machine gun with an interrupter gear so that the gun could be fired between the prop blades while the plane was flying. This innovation made the Eindecker successful and gave Germany the advantage in the air for about a year (1915 to 1916).

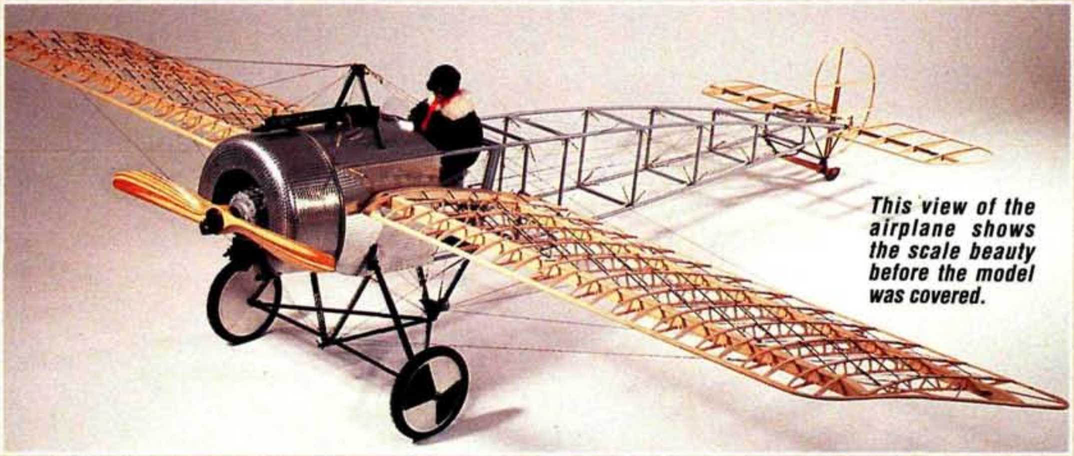
A museum-scale masterpiece for serious scale modelers

Ernst Udet, Manfred Von Richthofen (the Red Baron) and Max Immelman all flew Eindeckers. Immelman was flying this plane when he created the maneuver that bears his name. He was killed in an Eindecker on June 18, 1916.

The plane that I built is a replica of the one flown by Lieut. Kurt Wintgens—the first German ace. A replica of the full-scale plane is in the Champlin Fighter Museum in Mesa, AZ.

THE KIT

Proctor's* Eindecker kit comes in an attractive box, and it has the plans printed on it as well as a photo of the finished model. It's one of the most complete kits that I've ever seen. It contains four rolled sheets of magnificent drawings, a 30-page construction manual, a four-page parts list and 60 construction photos.



This view of the airplane shows the scale beauty before the model was covered.

The pieces are sorted by assembly and wrapped for protection. The hardware is packaged by type and/or assembly. All the parts are coded and identified on the plans and in the construction manual. The drawings are divided into zones, and they're cross-referenced throughout the manual and parts list. The parts list covers every element in the kit, and the parts are cross-referenced in the general catalogue. There are several prebuilt assemblies in the kit, so silver soldering isn't necessary. These jig-built assemblies are extremely accurate, and the cowl is of spun aluminum.

PROCTOR ENTERPRISES FOKKER EINDECKER E-III

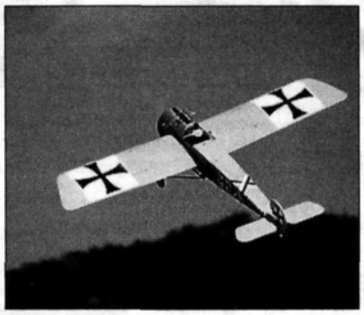
by FRED COLEMAN

FLIGHT PERFORMANCE

The Eindecker was flown on June 16, 1995, at the WRAM field in Patterson, NY. Not an accomplished flier, I asked my good friend Dan Carozza to make the maiden flight.

• Takeoff and landing

The ground handling with the fixed tail skid and rudder was very positive and effective even on our grass field. We lined up on the runway and slowly advanced the throttle to full. Dan held the plane on the ground and built up air speed. It seemed as though it took full power to lift the plane off the ground. The plane was out of trim. We added down-elevator and right aileron to trim it out. Takeoff would probably have been much better had the plane been properly trimmed.



This isn't a fast airplane. There's a lot of drag and resistance from the engine and the cowl. This, I suspect, was true of the real plane as well. Once in the air and properly trimmed, the plane flew well. The wing warping was very effective. As noted by Proctor, you must fly coordinated with the wing warping and rudder. We didn't use it on the maiden flight, but I'll add mixing of these controls through the radio.

The plane is a floater on landing. The speed didn't seem to bleed off very rapidly. Our biggest concern on landing was the prop clearance. With the 24-inch prop, there isn't much clearance. Dan landed on the main gear and let the plane settle. Our idle setting was probably on the high side, which was appropriate for a first flight. Because of this, the rollout was a little longer than I had anticipated. The large Proctor wheels added to this.

• High-speed performance

With this plane, this heading is a misnomer. The difference between high and mid throttle was hardly noticeable.

• Slow-speed performance

The plane excelled in this area. The controls remained effective, and the stall was predictable without a wingtip dip. We didn't have a chance to check the crosswind capabilities because there was no breeze. Our guess is that you wouldn't want a lot of crosswind with this model.

• Aerobatics

We didn't have a chance to try any aerobatics because when we landed after the initial flight, we found that one of the main wing and cabane support points had sheared off. If we had tried any inverted maneuvers, we probably would have lost the model. Based on what we learned, the roll rate with the wing warping should produce a decent roll.

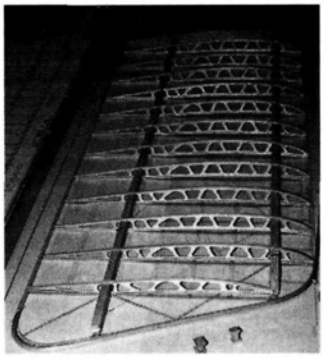
With the effective elevator, loops and inverted flight should be possible. The rudder also is very effective.

• Conclusion

This Eindecker is a lot of fun, and it should be flown in a scale-like fashion. I'm confident that it can perform any maneuver that the full-scale plane was capable of. The average to advanced flier should be able to handle this model. You just have to pick your days.

The wingtips, rudder and elevator perimeters are made of pre-bent reed. I had to re-shape the elevator outlines (probably because of the humidity) by spraying the parts with ammonia and water and pinning them over the plans.

The fuel-gauge housing and the windshield support are printed on sheet aluminum and have to be cut out. The other sheet metal for the front section of the fuselage is supplied in sheet aluminum and must be cut and formed to shape. The basic wing ribs are die-cut plywood.



The wing is built with scale, under-cambered plywood ribs. The ribs are cap-stripped, and the wingtip bows are preformed.

The fuselage sides are made with dowels and are built on top of each other to ensure symmetry. The author is drilling one of the many nail holes.

CONSTRUCTION

This is not a beginners' kit! It demands more than the average commitment of time and patience. I don't have a very sophisticated shop; however, there was nothing I couldn't accomplish. The tool that was most helpful was my drill press. I used CA throughout the construction. This allowed me to build up what looks like brazed joints on the fuselage, and it reduced the building time drastically.

I've never nailed an airplane together, so it seemed very strange at first; however, as I got deeper into the project, I saw the wisdom of this technique. The engineering and technology are very well thought out.

FUSELAGE

The fuselage construction is fairly straightforward. The dowel-cutting fixture that comes with the kit works well with a drill press. If you glue a ruler to the jig, the work goes much faster. I found it easier to build the second fuselage side over the first. This ensures that they will be identical. (Put a piece of wax paper between the sides.)

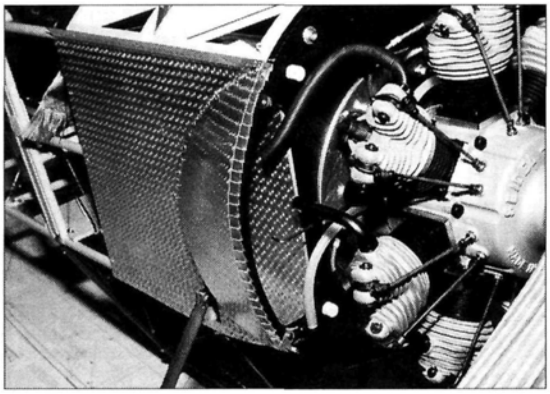
SPECIFICATIONS

Name: Fokker E-III Eindecker
Manufacturer: Proctor Enterprises
Type: WW I museum scale
Wingspan: 100 in.
Airfoil: scale under-cambered
Weight: 20 lb.
No. of channels req'd: 4 (wing warping, throttle, rudder, elevator)
Engine used: Seidel
List price: $469.95
Features: the Proctor Eindecker is the most complete kit I've ever seen. It has dowel fuselage construction; die-cut plywood wing ribs; formed elevator, rudder and wingtip parts; complete hardware; pull/pull control-cable system; wheels; a metal cowl and fuselage panels. Pre-assembled soldered parts are also included.

Hits
- Scale fidelity.
- Removable engine and radio module.

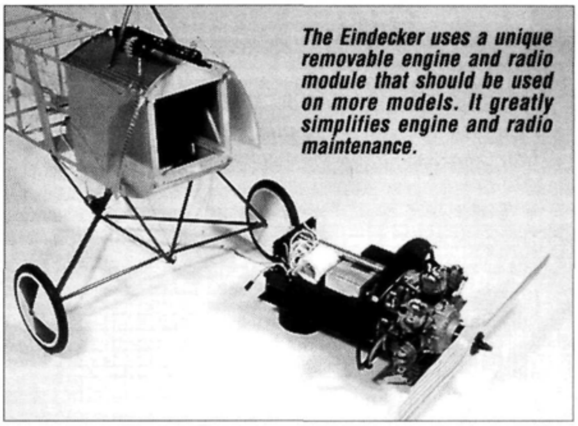
Misses
- Minor discrepancies in construction manual.

I used a no. 56 drill bit with my cordless Dremel tool to drill the pilot holes for the no. 10 nails and to ensure a tight fit. To drill straight in, elevate the first side more than the 1/8 inch called for. Not all the tabs on the no. 13 cable-anchor fittings are supposed to be bent. Some of these fittings have to be modified where there are no cables attached. Be sure that the no. 10 nails go through the hole in the no. 13 fitting. This is critical because, when the wire bracing is installed, all the members go into compression. In step 8, the scrap block should be 1/2x3 5/16x4 inches, and the tail should be elevated 3 5/16 inches, not 3 3/4 inches.



Detail of the fuselage cheek cowl and the modified exhaust pipe for one of the top cylinders.

The elevator bushing in photo 3 is incorrect. It isn't the straight piece depicted; it has the rudder bushing soldered to it. In step 10, don't glue the shock-arm mount (part 20) at this time because it has to be taken out later. When you assemble the tray slide as described in step 11, the rear corners of the slide have to be coped to fit to each other. This slide arrangement is a great idea and should be incorporated into more models because it makes it easy to reach the engine, glow driver, radio, batteries and fuel system. Also, the drill bit used in step 14 should be a no. 56 (not a no. 53); it provides a much better fit.



The Eindecker uses a unique removable engine and radio module that should be used on more models. It greatly simplifies engine and radio maintenance.

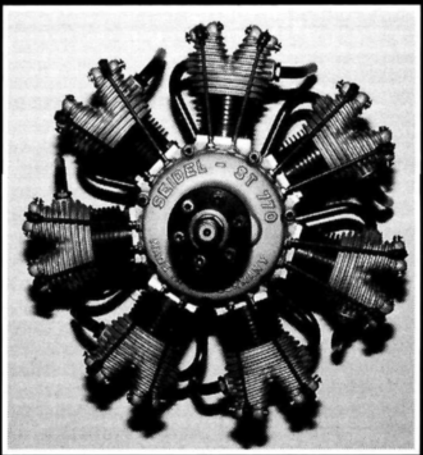
In addition to the wing-pin support backing on the inside of the uprights (step 16), you need to put a 1/16-inch shim member on the outside to compensate for the thickness of the laminated aluminum and plywood panel at the front wing-pin hole. This doesn't become apparent until you align the wings. Also, insert a 1/16-inch shim at the rear-wing attachment point behind part 110.

The wing-warping servo leads (cables) should go between the two dowel cross-

SEIDEL ST 770

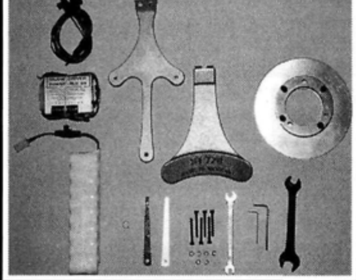
Proctor has designed the Eindecker around the 7-cylinder Seidel engine. By rights, the airplane should be an E-II because it was the one that had the 7-cylinder engine. The E-III had a 9-cylinder engine. A 1/3-scale Eindecker could use the 9-cylinder, but it would overwhelm the 1/4-scale version.

The Seidel ST 770 engine is manufactured in Malsch, Germany, by Wolfgang Seidel. In its 10th year of operation, this facility houses the CNC machinery and assembly stations as well as the offices. After being machined, the engines are assembled by hand. Proctor Enterprises of Aurora, OR, is the exclusive U.S. distributor of these engines.



The Seidel ST 770 7-cylinder radial engine is a work of art. The Eindecker and this engine were made for each other.

The engine comes with the necessary wrenches, feeler gauges, wiring harness and a standard engine mount. It also has a display mount. The engine that I used in the Eindecker is their Series I with the exposed pushrods. It looks more scale for this application than the Series II that they now manufacture.



The engine tools and accessories used with the Seidel radial.

The ST 770 has 7 cylinders, displaces 4.174ci, and it's rated at 4hp. The diameter is 9.05 inches, and it weighs 5.73 pounds. A 24x8 prop is recommended for the Eindecker, and the rpm range is 1,000 to 6,000 I'm turning 4,700rpm with the 24x prop.

Proctor makes an engine mount fo the Eindecker. I strongly recommenc it if you use this engine. I also usec the Profi-Tronic Power-Glo 2- onboard glow driver supplied b Proctor. This unit is used to start th engine and to ensure that the engin doesn't load up at low speed and a idle. It also gives a much smoothe idle. The unit is adjustable and run off a "Y" connector on the throttl function of the radio.

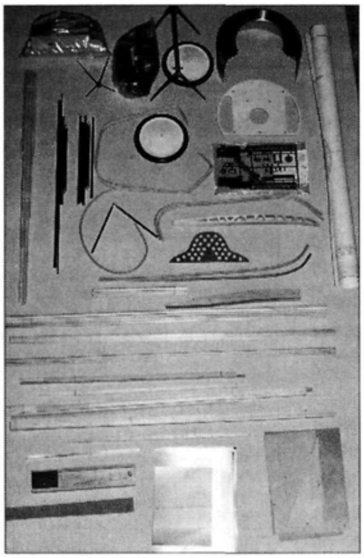
I contacted Don Nix of Powe Master* fuels, who brewed the neces sary break-in and running fuels fo me. Proctor recommends a break-i mixture of 9:1 (nine parts methanol t one part oil) for the first hour, a 12:1 mixture for the second hou and a 14:1 mixture thereafter. Don also used a mix of Klotz* syn thetic and castor oil. This fuel has zero nitro.

I use an electric starter with the Eindecker because I'm con cerned that I'll knock the machine gun off with the chicken stick The engine starts right now when choked and set at high idle. I' sure that hand starting wouldn't be a problem. The only criticism I have is that this very fine, expensive engine comes in a $3 ply wood crate. The other negative aspect is that the carburetor i mounted on the rear of the engine, but it doesn't have a mechani cal choke. In the Eindecker, this wasn't a problem because I ha access through the cockpit via a choke tube that came out unde the dash. You should consider how to solve this problem in you particular application before you buy this engine. The plane an the engine are made for each other.

members in the fuselage bottom. I made a servo support from lite-ply for this servo so that it was accessible through the front of the fuselage. Keep in mind that all components need to be accessible after the fuselage has been covered. I used a Futaba* S-134 ¼-scale servo for the wing warping.

To install the shock cord (part 113), I used a piece of ¼-inch-long brass tube (just large enough to slide over the shock cord), slid the tube over each end and crimped it with the cord inside. I then filled the crimp with CA and drilled a hole through the flat to install a screw. This method works very well, because the shock cord has to be removed for painting and maintenance. If you use a heavy engine, such as the Seidel, make sure that you wrap the cord around the landing-gear support bracket at least four times.

I strongly recommend no. 0 turnbuckles that Proctor lists as an option. It's almost impossible to prevent warping of the basic structure because of warps in the dowels. By using the turnbuckles, you can tune the structure and eliminate these problems. When you do the swage work, leave enough wire to work with. Make sure that you crimp the swage tightly. I went back over all swage points a second time to be sure.



Just some of the neat stuff included in the Proctor kit. The kit is very complete.

At this point, I stripped the fuselage of all fittings and painted it. To eliminate a possible incompatibility problem down the line, I also chose a covering method. I used F&M Enterprises'* Scale Stits model covering system that included primer and paint. I painted the structure a light gray.

RUDDER & ELEVATOR

The rudder is pretty straightforward, except that several pieces had to be reworked. The hole in part 57 should be ⅜ inch to fit the collar. The hole in part 56 was in the wrong location, and the piece was the wrong size. Apart from having to re-bend the reed outline, the elevator construction was fine. I recommend that you fill the voids in the rudder and elevator where the brass tube and the wood come together. This creates a base for the covering. In step 4, the holes in part 70 weren't pre-drilled; to prevent any slop, I drilled and tapped all members and used a 2-56 machine screw.

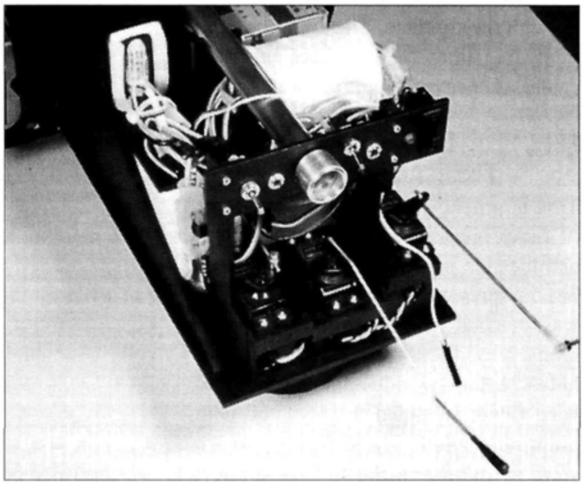
LANDING GEAR

All elements of the gear that require solder come assembled. In step 1, I used a $\frac{3}{32}$-inch drill bit instead of the no. 51 called for. This increased the clearance for the 2-56 bolts. All rigging should be done after the gear has been painted. The no. 94 spacers need to be ground down on one side to clear the fuselage members. Otherwise, you can't get the bolt through.

WINGS

The wing construction isn't difficult, just tedious. The die-cut ribs have to be cap-stripped. To do this, I made a jig by placing finish nails (⅛ inch larger than the rib's configuration) into a piece of ¾-inch plywood. The rib should also be elevated to center it on the capstrip. I used a piece of cardboard, cut short of the rib by about ⅛ inch on all sides. I used CA for this, and none of the capstrips became twisted. The false ribs can be capped in this same jig. Note that the capstrips on the false ribs extend over the spar.

To make the cutout in the rib for the spar, I created a master rib and used the cut-off material from each spar to align the other ribs. I routed the ribs with a Dremel tool. Take your time with this step. The wing alignment on the spars will only be as good as these cuts. To fit the wingtips, remember that they curve in the same way as the under-cambered ribs.



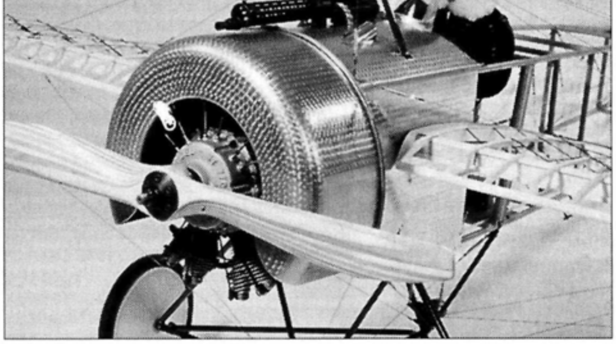
The choke tube, servos, radio switches and charge jacks are neatly mounted on a removable engine/radio module.

To install the cable-anchor fittings, only install the center screw until you can rig the wings to the fuselage and check the angle of the wires. This is the only way to achieve the proper alignment. Again, I highly recommend that you use the no. 0 turnbuckles on the internal wing cables. At this point in the manual, the wing rigging and the wing-warping control are described. I did this work after I had the rest of the plane built but not covered.

RUDDER & ELEVATOR RIGGING

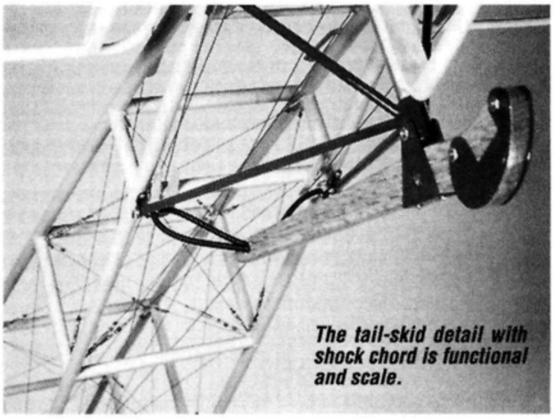
Be sure of your routing through the fuselage X-bracing. The control cables should clear all of these cables. I added $\frac{1}{64}$-inch plywood reinforcement where the cables exit the fuselage so that the fabric covering could be cut out at these points. Using a Du-Bro* ball link, I connected the elevator servo to the elevator quadrant assembly under the seat. Keep in mind that all of these controls have to be accessible through the cockpit after the plane has been covered.

I recommend that you rig the control cables with string or fishing line to set up your throws and check the cable routing



This front view of the Eindecker's cowl and engine show how beautiful the model is. The burnishing effect adds to the model's appeal.

through the fuselage. These can become your drag lines for installing the final cables after covering and painting.



The tail-skid detail with shock chord is functional and scale.

COWLS AND FUSELAGE COVERS

This is probably the most difficult part of the project. I laminated the bottom and the side panels to the plywood with 3M-77 spray adhesive. The corner angle was attached with the pins supplied for rivets. I used a no. 75 drill for the rivet holes. After the sides and bottom had been fitted, I painted the plywood with aluminum paint. These panels, which were aluminum in the full-scale aircraft, show through the open cockpit.

I used a utility knife for scribing the parts for bending. Be very careful with the depth of your scribe marks. I ruined the original .015-inch material supplied for the cheek cowls and replaced it with some .019-inch material from the hardware store. By substituting this heavier material, I was able to eliminate the fold on the bottom edge and create a much cleaner detail. It was hard to bend the cheek cowl into the flared top of the side pieces, and I had to add a screw at this point. There doesn't seem to be a good solution to this detail. You just have to be patient and fuss with it. In order to ensure symmetry, I made a cardboard template for these cheek pieces.

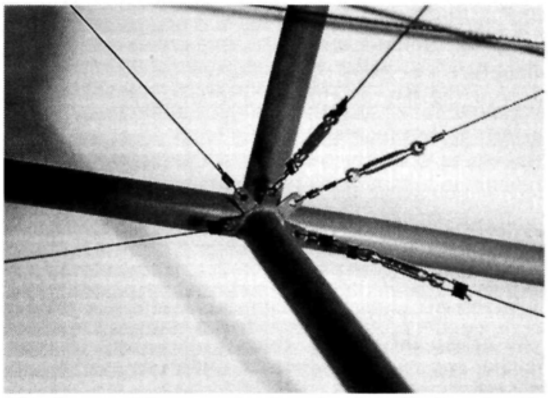
The sound of the 7-cylinder radial was awesome, and it matches the airplane in a way that is indescribable.

To duplicate the burnished-metal effect, I used my drill press and a ¼-inch, stainless-steel Dremel brush. With the exception of the cowl, I burnished all the pieces before bending them. I drew a ¼-inch grid on all the surfaces to be burnished and set the drill-press depth stop to the proper diameter. (It's critical that all circles have the same diameter.) When you're finished with each piece, wipe it with a clean, dry cloth. Don't use polish or solvents. To burnish the cowl, I built a Z-shaped fixture so that I could rotate the cowl and maintain even pressure with the brush. I burnished the radiused corners (freehand) with a Dremel tool.

After burnishing, carefully bend the fuselage top to shape. The machine gun's height has to be reduced. Compare it with the side view for this dimension. To prevent the machine gun from rotating, I fastened it with two screws. After mounting the gun, I cut slots in the fuselage top for the cartridge belt.

Be careful when you bend the windscreen aluminum supports. It can be done, but easy does it. The instrument-housing cover also must be handled carefully when you bend it. I used a large-diameter dowel to shape it. I didn't burnish the windscreen support or the instrument cover because of their sizes; I simply polished them.

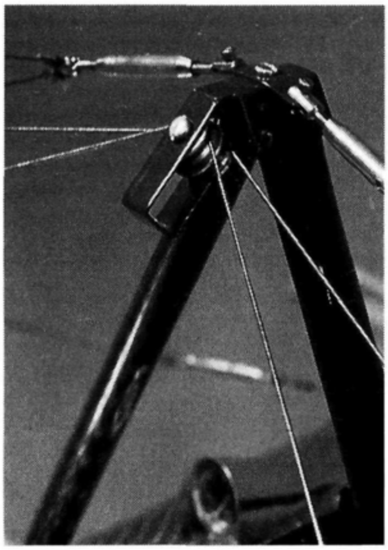
The cowl cable channel supplied in the kit was too small to allow the two turnbuckles to be placed side by side, so I alternated the turnbuckles—one on the left and one on the right.



This is one of the many fuselage bracing attachments with turnbuckles attached.

RIGGING

I did the wing rigging after the entire plane had been built but before I covered it. Rather than use the pins that came with the kit for my connections, I used some 0-80 and 1-72 stainless-steel, socket-head machine screws and taps from Micro Fasteners* and tapped all of the attachment points on the wing to accept the bolts for these connections. When you rig the warping cables, the plans call for ⅜-inch washout in each wingtip. To maintain the wing settings, I attached all of the upper cables in a fixed position and made all adjustments with the bottom cables. You'll have to re-attach these at the field. Be sure that your crimped fittings are well done.



The top of the wing-warping pylon has wing-support wires attached at the top and warping wires that go over the pulleys.

COVERING

I used the Scale Stits model covering system. The Eindecker I modeled was a replica and had a modern covering system, so this seemed appropriate. If you use a polyester shrink-fabric covering, brace and reinforce the wingtips and the perimeter of the elevator. The material shrinks as much as 10 percent. I was concerned about the under-cambered wing, because I had never covered one before. I spoke to Chip Mull of F&M Enterprises, and he suggested that I try the "wick-through" method used by some full-scale fliers. First, you coat the airframe with the adhesive, lay on your covering, and wick the adhesive through with solvent (MEK). This worked very well.

I painted the fuselage structure with Stits primer and paint (you should do this, too, because it's an open-cockpit plane), and then I covered it. I coated the frame with adhesive and then had my wife sew a sleeve, which I pulled over the framework. I shrank the sleeve and wicked the adhesive through. Do a good job when you paint the frame; the adhesive tends to lift the paint. Proctor furnishes reinforcements for the fabric at the wing-support wires. I put these under the fabric as I went. After the basic covering had been completed, I used Tite Bond glue to simulate rib and fuselage stitching. F&M

Enterprises has a variety of tapes to apply over the "stitching"; I used ⅜-inch non-pinked tape. I then sprayed on two coats of filler—one coat of ultraviolet protection (to act as a base coat for the final color) and two coats of finish. I highly recommend this system for a scale finish. It's no more difficult than silk and dope, but it's far more durable.

On the initial flight, I experienced interference problems with the radio. Through the efforts of Dave Abbe of DAD* and Bob McDaniel of McDaniel RC*, we discovered that the aluminum ultraviolet coat was shielding the antenna that was inside the fuselage. I recommend that you eliminate the ultraviolet coat; it won't affect the final finish.

RADIO

The radio is a Futaba Super Seven 7UAFS with a DAD 7-channel receiver. With the exception of the throttle servo, which is a Futaba 148, I used Futaba S131S servos throughout. Because of all the metal cables that ran parallel to the antenna (which was inside the fuselage), Dick Hansen recommended that I also install a Jomar* Glitch Buster. These changes were worthwhile.

SCALE DETAILING

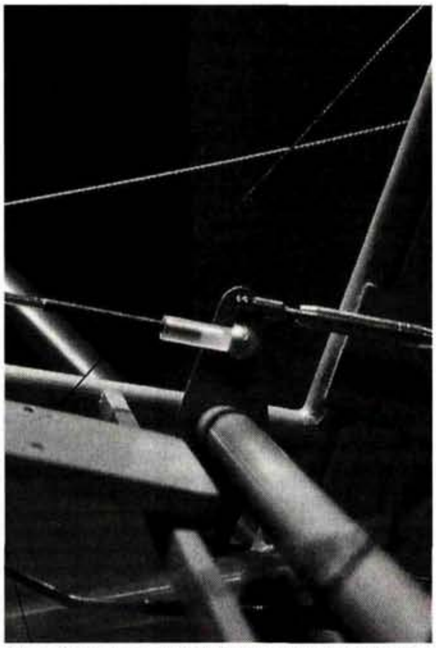
Using documentation, I detailed the cockpit, rib stitching, wheels, etc. The amount of detail supplied with the kit makes detailing the model easy, and the kit deserves these final touches. The scale graphics were provided by Dry-Set*, and they match the full-scale ones exactly. To paint the crosses on the wings, I made a master from a copy of the cross shown on the drawings, traced them onto the wings, masked them and painted them with an airbrush. I used a ¼-scale J&J Hobbies* full-figure pilot. Their pilots are outstanding, and they can be configured to fit in your cockpit.

FLIGHT PREP

The center of gravity (CG) is shown on the plans. The manual calls for the plane to be balanced with a full tank. This isn't correct if the tank is mounted forward of the CG the way mine is. It applies only if the tank is behind the CG. I had to add 3 ounces of weight in the tail.

Before flying the plane, I broke in the engine on the airplane for 3 hours. I prefer this method because it tends to reveal problems before the first flight. It also offers an opportunity to test all other systems.

I did the usual range checks; there was interference with the engine running and the transmitter antenna down. I moved the receiver antenna to the outside of the fuselage and, with the antenna extended, the



The elevator control-linkage setup is under the pilot seat. The ball link connects the tiller arm to the servo, and the control cable leads to the elevator.

interference went away, and the radio was rock solid.

The setup time at the field was about 45 minutes because I had to wire the eight turnbuckles on the bottom of the wings. I found out that, for the bottom connections, I could have saved time by using the scale hitch pins from Balsa USA's* ⅓-scale Cub. If the wires are tensioned properly, you can set up all your rigging (including wiring the turnbuckles) before you get to the field. You can insert the hitch pins at the field. The sound of the 7-cylinder radial was awesome, and it matches the airplane in a way that is indescribable.

Proctor's Eindecker kit has been extremely rewarding, and I would highly recommend it to the serious builder who is looking to get into scale. You probably won't see four or five of these at any meet. I should also mention that the help I received from Proctor with the kit and the Seidel engine was great.

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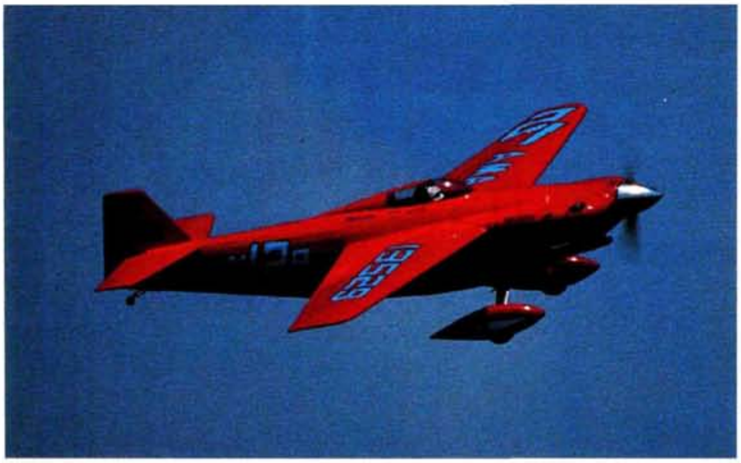


Ed Rankin's Shoestrings made a strong showing at Galveston. Ed captured 2nd in Gold with this 28-pound, Brisson-powered original.

GALVESTON

by ROB WOOD

THE THUNDER AND ROAR of untamed horsepower descended on the Galveston Municipal Airport once again on July 10 to 16, heralding the opening of the second annual giant-scale air races. Spectators were treated to Unlimited, AT-6 Texan, Formula One and Thompson Trophy racing and, except for lunch, there was never a break in the action.

The variety of competing aircraft was astonishing—especially in the Unlimited class. There were two Pond Racers, a couple of Tsunamis, several Sea Furys and an absolutely gorgeous P-38 built by Dennis Crooks and Robart's Tom and Bob Walker. Dennis flew the Lightning with impeccable precision and, although the twins didn't threaten the faster single-engine Lancairs this year, they provided a welcome distraction from the seemingly endless parade of Mustangs; they also took a couple of silver trophies. The age of the Stiletto seems to be waning, but alas, the Lancair IV is still the aircraft to beat.

The story of the year for the AT-6/SNJ class is the Race Pro kit, designed by Otto Burgdorf and produced by Joe Marine. These aircraft have hollow, stiff wings and slippery airframes, and they weigh exactly 25 pounds (the minimum allowed for these

This 40-pound Pond Racer was one of two that competed this year, and it was the first time a Pond has been entered in the races. This scratch-built twin, flown by A³ pilot Ron Goodrich, edged out Dennis Crooks' incredible P-38 to take 4th in Unlimited Silver. Powered by two 8.8cid. A³ twins on Byron fuel, the Pond proved (finally) that twin-engine racers can hold their own.

RacePro Engineering AT-6/SNJ Texans have begun to dominate the AT-6 class. This 25-pound beauty was sponsored by the Discovery Channel and took 1st in Bronze with Ron Eisner on the sticks.

competitions). They fly fast and make tight turns, and they took six of the 15 places—including four of the five Gold trophies! They're definitely the airplane to beat in the AT-6 class.

Although the Thompson Trophy class had only a few participants, it provided a welcome dash of color and historical perspective. The Formula One class included several new scale models not seen in previous races.

The event took place in the middle of a heat wave and, according to Classical Racing Team's Elaine Murphy, the high temperatures gave a whole new meaning to the term "heat races." Although the heat was unrelenting for most of the week (110+ degrees in the shade, with 90 to 99 percent humidity), some relief was provided by storm clouds that rolled in on a few occasions.

Richard Oliver (Caveman Racing Team) repeated his 1994 Formula One victory with this 29-pound Ed Rankin Shoestring and took home a check for $1,500!

The Discovery Channel made history at Galveston '95 by becoming the first major corporation outside the model airplane industry to sponsor the races. The connection between giant-scale warbird racing and Discovery's "Wings" series and television programs is a natural. Discovery and JR Radio sponsored a race team: shown here is Classical Racing Team's Cosmic Wind, flown by Mike Boso to 4th place in Gold and powered by a Webra 75cc prototype engine on gasoline.

CHANGING WITH THE TIMES

Galveston '95 saw the introduction of a new system for racing starts. Gone were the pace planes, which were always a source of delays and uncertain starts. They were replaced by a huge, 1-minute countdown clock. When all four aircraft were in the air and on the course, the clock would begin to tick, and all the pilots had 60 seconds to jockey for posi-

'95 SPEED & THUNDER FROM TEXAS

A^3 Racing has clearly become the team to beat in the Unlimited class. This 37-pound D&W Aircraft Roto Finish featured the new A^3 11.4cid twin. Cliff McGee piloted the foam-and-glass modified Mustang to a 1st-place finish in Silver.

On the last day of competition, Roger Cirelli's Ed Rankin Shoestring leaps for the sky and a fifth-place Gold trophy. Steve Ehlers' modified Brisson 5.8 (running on 100LL aviation gas) and a Race Pro 20x20 prop made the difference. Roger's team—"Middle Age Crazy"—dominated the Formula One class at Muncie in '95 and placed 1st, 2nd and 3rd in the Gold!

This Team Zap Texan flown by Dennis Crooks placed 4th in the T-6 Silver class. The G-62 powered Byron kit weighed in at 25 pounds.

Racing veteran Duke Crow flew this 28-pound Lil Quickie beautifully; he finished 8th in the overall standings. The fiberglass, foam-and-balsa Formula One was built from a Paul Steiner kit, and it was powered by a Sachs-Dolmar 5.8 on gasoline.

Primary sponsors: Pacer Technology (ZAP products), The Discovery Channel and Westinghouse Broadcasting. Thanks for your support!

Ed Rankin's touch was everywhere at Galveston '95. Here, Roger Cirelli demonstrates the nimble flight characteristics of Ed's Shoestring (foreground), just prior to overtaking Larry Skiles' Nick Ziroli Ole Tiger in round five of the heats.

Zapped again! Rob Pastor's Herbrandson 280-powered Stiletto took 2nd in Gold. Zap continues to support giant-scale racing in a big way by sponsoring racers and the racing events.

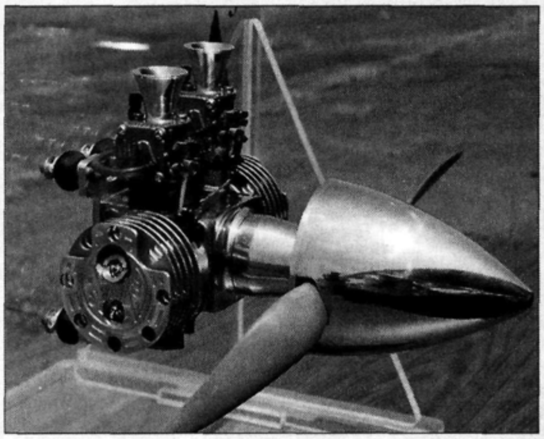
tion. The trick was to fly the course at a pace that would place an aircraft at the start/finish line at the sound of the horn; heat races were won or lost according to how well the pilot and the caller anticipated the start. If the plane was too far back, catching up was often impossible; if it arrived at the line too early, the offender received a ½-lap penalty.

There were virtually no protests this year (maybe spending 10 to 12 hours in a wet furnace drained away all contention), and the racing was hard, clean and hair-raisingly fast; several Unlimited racers were clocked at well over 210mph! The countdown clock eliminated the guesswork in the starts, and the average heat races were only 7.5 minutes! The new method worked so well that there was time for every entry in Unlimited, AT-6 and Formula One to race in six heats; the lowest heat score was then dropped from the total. Because so many heats were run, the trophy positions were more accurately determined by speed and performance. In previous years, too much guesswork was involved in totaling race scores.

This year, The Discovery Channel sponsored the Galveston race as well as a team of its own. (It was also a major sponsor of Madera this year.) The Discovery Channel's entry into the giant-scale racing arena marks the beginning of corporate America's financial investment in the maturing sport. Despite reservations that some R/C veterans may have about the "professionalization" of R/C air racing, this involvement provided—and will continue to provide—a much-needed financial boost to the R/C industry. The day will come when racing teams no longer have to beg for free products from the R/C community's mom-and-pop suppliers; instead, they'll be able to afford to pay retail for their racing products. This infusion of capital will allow the smaller companies to spend money on research and development, and that will facilitate the production of better, safer products. This influx of money will benefit everyone who loves R/C flight—from the would-be Unlimited Gold winner to the weekend sport flier.

Dick Sizer built this beautiful balsa-and-foam Tsunami according to the USRA down-size rules; it has great potential in the Unlimited competition. It's powered by a modified McCullough 130cc engine on alcohol.

No room for superstars. Teamwork pays off for the A³ Unlimited Racing Team, shown hard at work on the 5th-place Gold Lancair IV (a KT Aviation kit).*



Induction Systems has combined a KT Aviation Lancair with their own A-Cubed (A^3) motor for a seemingly unbeatable airplane. The 8.8cid twin designed for Bill Cunningham had been steadily gaining ground on the Aerrow 200, until it finally took six of the 15 Unlimited places at Galveston '95. The light-weight twin produces more than enough power to take on even the largest of the Unlimited fire breathers—especially in a 27- to 33-pound Lancair IV. Smaller engines with high power-to-weight ratios have arrived!

DOMINATOR: A-Cubed Takes Six

SOLVING THE PROBLEMS

The entry-level, stock AT-6 Texan class has long been a source of contention among racers; faster racers have been accused of cheating. The class was, however, given a new lease on life when all five Gold-trophy winners were impounded after the race and all five Zenoah G-62 engines were again scrutinized by technical inspectors. None of the engines showed any signs of tampering! This revelation was a relief to the beleaguered race officials and may go a long way toward reassuring potential competitors that the AT-6 class is alive and well—and clean.

The Unlimited Lancair IV is another recurring source of contention. This home-built, teardrop-shape bullet with high-aspect-ratio wings has clearly demonstrated the ability to dominate the races. Bill Cunningham's purple-and-white beauty easily clinched the top Gold-trophy dash. Although the full-size Lancair never raced at the National Championship Air Races at Reno, it was entered at that event just to show how fast it is. Its top speed of 265mph would never have made it a contender, but a fluke in the giant-scale racing rules—that it completed a qualifying run—allowed it to be entered in the model competition. With only two exceptions, it has been winning ever since.

AT-6

Pos.	Team/Pilot	Race no.	Kit	Weight	Prize
Gold					
1	Burgdorf/Fred Burgdorf	75	Race Pro	25 lb.	$1,150
2	Pond Scum/David Layne	717	David Layne Designs	28 lb.	$900
3	Aero Sport/Archie Snider	191	Race Pro	25 lb.	$650
4	Aero Sport/Carl Allmendinger	691	Race Pro	25 lb.	$500
5	Aero Sport/Kelly Carter	120	Race Pro	25 lb.	$300
Silver					
1	Tregellas/Charles Loudermilk	26	Byron	28 lb.	$275
2	Hobby Country/Jim Hoffer	2	Hobby Country	25 lb.	$250
3	Sagami-Do/Takasohi Komuro	03	Race Pro	25.5 lb.	$225
4	Zap/Dennis Crooks	140	Byron	25 lb.	$200
5	Blues Brothers/Diego Lopez	94	Byron	27.5 lb.	$175
Bronze					
1	Classical/Ron Eisner	667	Race Pro	25 lb.	$165
2	Sutherland/Larry Sutherland	90	Saxton Glass	27 lb.	$150
3	Rahm Racing/Randy Hill	06	Byron	30 lb.	$135
4	Robart/Tom Walker	20	Ziroli	26 lb.	$120
5	French/Fred French	17	Byron	25 lb.	$100

*Note: all fuel provided; all props (APC 22x10) provided;.

UNLIMITED

Pos.	Team/Pilot	Race no.	Aircraft/Kit	Weight	Engine/disp.	Fuel	Prop	Prize
Gold								
1	A^3/Bill Cunningham	889	Lancair/KT	31 lb.	A^3/8.8ci	own	Race Pro	$3,000
2	Classical/Rob Pastor	129	Stiletto/Sky	36 lb.	Herbrandson/280cc	gas	Race Pro	$1,500
3	Miller/Scott Manning	10A	Sea Fury/D&W	37 lb.	Aerrow/198cc	gas	Zinger	$1,300
4	Desert Demon/Chuck Collier	13	P-51/scratch	42 lb.	Aerrow/198cc	gas	Zinger	$1,200
5	A^3/ Harold Moirfalise	886	Lancair/KT	35 lb.	A^3/8.8ci	Rich's Brew	Race Pro	$1,100
Silver								
1	A^3/Cliff McGee	887	Roto Finish/D&W	37 lb.	A^3/11.4	alcohol	Race Pro	$1,000
2	Blues Brothers/Clay Melnfield	711	P-51/NA	NA	NA	alcohol	NA	$925
3	Braun Racing/Ralph Braun	68	P-51/scratch	35 lb.	A^3/8.8ci	Byron	APC	$850
4	Braun Racing/Ron Goodrich	820	Pond Racer/scratch	40 lb.	A^3/8.8ci		Race Pro	$775
5	The Menace/Dennis Crooks	140	P-38/scratch	49 lb.	Husky Challenger			$600
Bronze								
1	Team Wings/Dave Hendon	177	Sea Fury/D&W	41 lb.	A^3/8.8ci	Power Master	Race Pro	$500
2	Rahm Racing/Randy Hill	06	P-51/John Eaton	41 lb.	Villines/7.3	Byron	APC	$450
3	Futaba/Bruce Brown	15	P-51 Stiletto/scratch	38 lb.	3W/7ci	Power Master	Zinger	$400
4	DNF							
5	DNF							

THE RETURN OF THE LIGHTNING

Nick Ziroli has always loved the P-38 Lightning, so when he learned that Dennis Crooks wanted to build a fiberglass version of the Sea Fury for this year's races, Nick talked him into building a P-38—an incredible-looking airplane. Given the design, with adequate power and veteran fingers on the sticks, it should be very competitive. Dennis started to build the plug for it at home before Nick's drawings were even finished. Bob Walker at Robart caught wind of the project and got involved, too, moving the construction project to his St. Charles, IL shop.

Dennis Crooks puts his P-38 through its paces during heat racing. Dennis took off and flew the 49-pound Lightning without noticing that one of the Husky 6.6 twins had died. The airplane performed with authority, and he was able to land without mishap.

The twin-engine, twin-boom fighter has been a rare competitor at the full-scale Reno air races and an even rarer competitor as a giant-scale model. In fact, the only other P-38 that has qualified to race in the past five years is a 5.8 Sachs-powered contender that was entered by H.L. Skates in the very first race (Madera '91). The 55-pound bird was eventually withdrawn because of a cracked wing spar.

With its twin 6.6 in-line Husky Challenger engines and composite airframe built using a two-piece fiberglass mold, the Lightning is an engineering marvel. Flown by Dennis Crooks, the 49-pound twin tracked beautifully, turned gracefully and delighted the crowd of spectators and contestants with every flight.

SPECIFICATIONS

Airplane type: P-38 Lightning (scratch-built plug from Nick Ziroli plans; two-piece fiberglass fuselage mold).

Racing class: Unlimited

Nickname: The Menace

Race number: 140

Scale: 18%

Wingspan: 114 in.

Length: 85 in.

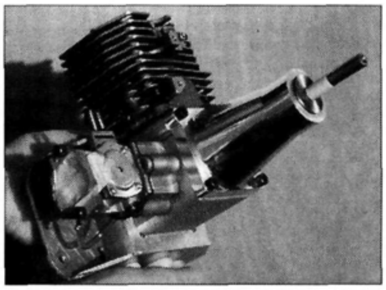
Weight: 49 lb.

Fuel: Klotz/unleaded gas

Power: two Husky Challenger 6.6cid in-line twins; 8 lb. each

Prop: APC 22x20

Landing gear: Robart



John Eaton designed this J-44 engine, which is available directly from his company—J&K Products. Specs: 4.4cid; reed valves; 7 lbs.; gas or alcohol; $950 direct.*

The Nemesis is the world's fastest Formula One, and it dominates the full-scale Reno races. John Westbrook, flying for the A Team, landed 3rd in Gold with his 35-pound version, built from Wendell Hostetler plans.

Many racers complain that the Lancair does not belong in a field of "heavy iron" warbirds, which includes the P-51 Mustang, Corsair, Sea Fury, P-38 Lightning, Bearcat and other WW II-era fighters, while others complain that the airplane is simply not safe, especially with a 280cc engine bolted to the front of it. Although it's true that many Lancairs self-destruct during the grueling heat races, those that survive generally end up in the Gold-trophy races. Time will tell if the Lancair problem will come to a successful resolution.

The Hi-G Promotions staff and the Unlimited Scale Racing Association hosted a topnotch event and should be commended for running one of the tightest, cleanest races seen in the five-year history of the sport.

Giant-scale racing could not exist without the help of volunteers who selflessly bake out in the hot sun to keep events running smoothly. All the flight-line personnel, turn callers, tech inspectors and administration personnel should be commended for a job well done. And, of course, nothing at all could happen without the generous support of sponsors such as The Discovery Channel, Zap!, TruTurn, Westinghouse Broadcasting and many others. This year, Hi-G Promotions did a little sponsoring of their own: an AT-6 kit was raffled off, and the proceeds were donated to Ronald McDonald House.

For information on next year's Texas races, contact Wiley Brown at (713) 469-3388. ■

FORMULA ONE

Pos.	Team/pilot	Race no.	Aircraft/kit	Weight	Engine/disp.	Fuel	Prop	Prize
1	Caveman Racing/Rich Oliver	7	Shoestring/Rankin	29 lb.	Aerrow/100cc	Rich's Brew	Bolly	$1,500
2	RB Racing/Ed Rankin	12	Shoestring/Rankin	28 lb.	Brison/5.8	gas	Race Pro	$925
3	The A Team/John Westbrook	21	Nemesis/scratch	35 lb.	A&M Sachs/5.8	Suneol	Zinger	$750
4	Classical/Mike Boso	84	Cosmic Wind/Steiner	31 lb.	Webra/4.6	gas	APC	$500
5	Middle Age Crazy/Roger Cirelli	69	Shoestring/NA	28 lb.	NA.	NA.	NA.	$300

THOMPSON TROPHY

Pos.	Team/pilot	Race no.	Aircraft/kit	Weight	Engine/disp.	Fuel	Prop	Prize
1	Santmeyers/Mel Santmeyers	24	Gee Bee (Y)/Haffke	26 lb.	Centermark/4.6	gas	Zinger	$1,000
2	Classical/Mike Barbee	4	Gee Bee (R-2)/Byron	25 lb.	Zenoah G-62/3.7	gas	NA.	$500
3	DMM Racing/Kevin Dietrich	7	Gee Bee (R-1)/Byron	25 lb.	Zenoah G-62/3.7	gas	NA.	$250

Highest Place Finish: Twin Engine
Braun Racing/Ron Goodrich

Fastest: AT-6
Sagami-Do/Takasohi Komuro

A lion's share of the spinners were TruTurns.
A lion's share of the landing gear were made by Robart.

PRODUCT REVIEW

FLIGHT INSURANCE FOR EVERY MODEL

Hobbico Accu-Cycle

by ROGER POST JR.

I'VE always thought that using the charger that came with my radio was an efficient way to keep the batteries at peak performance. I knew that they would lose some of their overall mAh capacity and would have to be replaced after a few years. I was also told that every once in a while, I should deep-cycle my batteries to give them a longer life. This meant leaving the radio on, discharging the batteries and then recharging them. I could always see the TX readout, so I was safe knowing that battery pack's ability, but unless I had a voltmeter, I was taking a real gamble with the flight pack.

Hobbico* has put the odds in the flier's favor. Their new Accu-Cycle charger, analyzer and conditioner for R/C battery systems is a must for every pilot. It's extremely easy to use, and it will analyze Ni-Cds as well as NiMH batteries. The Accu-Cycle is two separate analyzers in one unit, and it can charge, discharge, or cycle RX and TX battery packs simultaneously or independently. The feature I like the best is the twin LCD readout that shows both battery packs' capacities in either mAh or minutes. This readout provides the answer to that age-old question: "How long will my batteries last?"

The Accu-Cycle uses standard banana-plug connectors (not included), and it has a thorough instruction manual that includes a quick reference guide. I suggest you read the entire manual so that you're completely familiar with this product. The manual also has sections on NiMH batteries and the polarity of the various brands of radios. There is also a handy charge-rate guide on the left side of the charger. (See photo.)

I have two JR* and two Futaba* radios, and I was curious to see how the batteries were holding up. First, I tried the JR PCM 10S. Both of the packs are rated at 700mAh. When you connect a JR TX to the Accu-Cycle, *you must reverse the positive and negative leads.* Because both RX and TX packs can be charged at once, I will describe the TX first. There are only three switches that you need to be concerned with on the TX side of the charger: the rate switch (which has two settings—50mA and 125mA), the cell-selector switch (6-, 7-, or 8-cell packs) and the discharge-rate switch (250 is for 1000mAh packs and below, and 500 is for 1000mAh packs and above). Because the JR TX is an 8-cell pack, I kept the cell-selector switch on "8." The charge rate can be determined by looking at the handy chart on the left side of the charger. I used 50 because my TX pack was 700mAh. The discharge rate was 250 because it was below 1000mAh.

Once I had all of the switches correct and the TX connected, I turned on the unit and pressed the yellow discharge button. The red light came on, and the LCD displayed zero. When the discharge had finished, the display showed the capacity of the battery in mAh and minutes.

The instructions recommend that you always discharge before charging so that you don't risk overcharging a battery. Next, I turned my attention to the RX side. It has the same three switches as the TX side, but there is one added charge rate (25mA), and the cell selector is for 1-, 4-, or 5-cell battery packs. Since I was cycling a 4-cell, 700mAh pack, I set the rate at 50 and the selector at 4. The discharge rate remained the same. Then I hooked up the batteries and pressed the yellow button. Again, the red light came on, and the display showed zero.

The Accu-Cycle will discharge your packs to 1.05 volts per cell and then automatically start to charge them. The charging sequence takes 15 hours, and then the unit goes into a trickle-charge. The green light goes on when the batteries are charging and then starts to flash during trickle-charging. Some of my packs took longer than 15 hours to fully charge and go into the trickle mode. I discovered that all of my TX and RX packs—no matter how old they were—needed to be cycled three times to come up to their full capacity. Only one of my battery packs—a TX—needed to be replaced, because it would not come up to 70-percent capacity. This was a real eye opener and showed me that you can't always believe what's on the battery's label.

Here's a sample readout of the cycling of my 600mAh pack: first cycle—476mAh; second cycle—546mAh; and third cycle—598mAh. The final capacity was 146.5 minutes.

The Hobbico Accu-Cycle is a great way to determine the minutes duration and mAh capacity of your battery packs, and it does this in a very user-friendly way. Don't get caught without one. ■

**Addresses are listed alphabetically in the Index of Manufacturers on page 146.*

FIELD & BENCH REVIEW

A 2-D daredevil

by KEN DE FUSCO

MORRIS HOBBIES

GEE-WHIZ-BEE

MORRIS HOBBIES* appeared on the scene a couple of years ago and started a revolution. Their Profile Hots could do everything that wing-and-boom fun fliers could do, and when it was flown with an MVVS 40 engine, it could also be hovered. Encouraged by that success, Morris strove for more, slow, knife-edge flight and knife-edge hover. The Gee-whiz-Bee was the result.

CONSTRUCTION

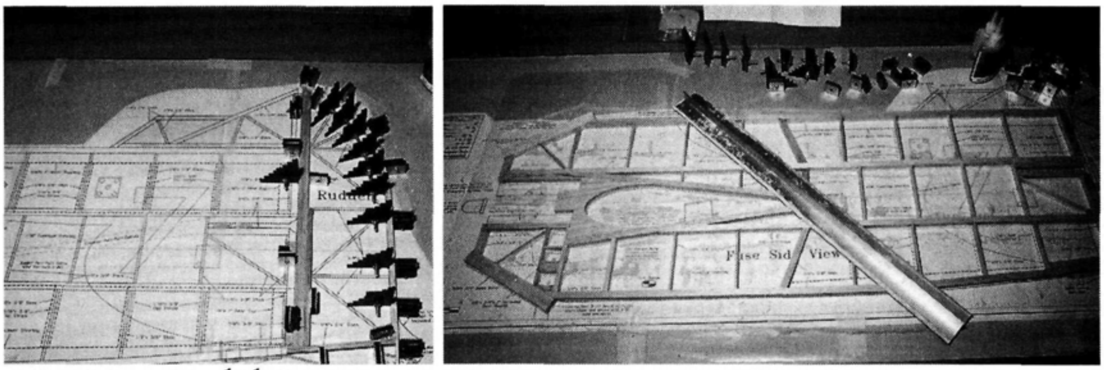
• **The fuselage.** I selected the stiffest, densest wood to build the core structure that ties the engine, the wing and the tail together. It's important that the joints fit tightly. During engine and landing-gear mount construction, I used the hardwood blocks as spacers to ensure proper fit and alignment; don't glue them into the frame. I sanded the finished frame with a long T-bar.

Pull/pull cable sheaths were next. I made a "cable end-point gauge" out of a 3/8x1/8x6-inch scrap of balsa over the wing plans, and I marked out the center and end points of the rudder and elevator servo arms. I tack-glued this gauge to a corresponding point in the wing saddle. I now had reference points with which to plan the forward-end-cable routing.

To allow the cable sheaths to pass through the fuselage, I marked and notched the frame cross-members. Make sure that you anticipate con-

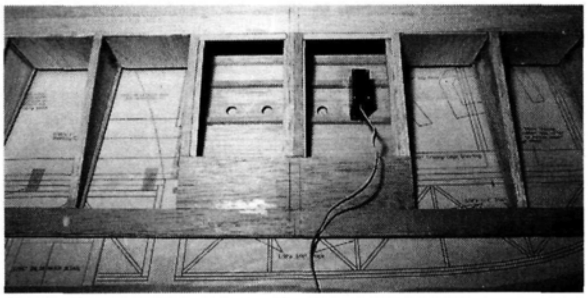
PHOTOS BY KEN DE FUSCO & WALTER SIDAS

trol-surface requirements for the angle and amount of pull. The best way to do this is to simulate the control-surface horn location by "mocking" the control horns on scraps of wood. Once the sheaths have been glued into place, mark the exit points on the sheeting and cut corresponding slots. I followed the instructions except for gluing the left-side sheeting. To get the flattest possible fuse, I positioned and tacked the sheeting in only two places at the front of the fuse. Then I flipped the frame over so the sheeting faced downward, and I used weights to ensure that it would remain flat. To finish gluing, I wicked CA along the frame members. After removing the weights, I installed the right side. To provide an exit for the upper elevator cable, I added one piece of sheeting that wasn't described on the plans. I completed the fuse construction by installing capstrips, hardwood blocks and the canopy. Edge trimming, rounding and more sanding followed.



Left: while I soaked two 1/8x1/4-inch sticks in ammonia, I placed enough magnets on the board to produce a smooth curve that matched the print outline. With the pieces sandwiched together, I slowly bent and anchored them with more magnets. Right: a 22-inch-long T-bar. To prepare for sheeting, sand the fuse frame to ensure that it's flat.

• **Stabilizer and elevator.** The tail parts are made of 1/4-inch-thick stick construction and are built over the plans. I tack-glued the elevator and stab together for sanding, and I finished the job by prepping the parts for the cloth hinges. Modeling-knife slits, centered in each control-surface spar, made hinge preparation easy. I beveled the elevator leading edge with 45-degree chamfers.



To position mounting rails inside the wing, I used a servo as the template.

• **Rudder and ailerons.** The only tricky part to building the rudder was laminating the trailing edge. While two 1/8x1/4-inch sticks were soaking in ammonia, I placed enough magnets on the building board to produce a smooth curve that matched the print outline. With the pieces sandwiched together, I slowly bent and anchored them with more magnets. When I had them in place, I trimmed and CA'd them together and to their mating parts. I completed the assembly and made slots for the hinges. Aileron construction is very similar to that of the rudder.

• **Wing.** I edge-glued leading-edge sheeting to form four 22x5x1/16-inch sheets. Position the wing top sheeting parts on the building board, and glue the rib capstrips into place. Then glue the spars, the doublers and the ribs. The ribs are not "mirrored image" along the chord line. The trailing edge is perpendicular to the top side of the wing. The ribs are installed upside-down so, to ensure that they don't get put in the wrong way, mark one edge of each rib.

Now install the bottom spar, the leading edge and the trailing-edge spar and continue construction with the rest of the sheeting and the capstrips. To position mounting rails inside the wing, I used a servo as the template. Wingtips and hatches were easy to construct and install.

FINAL ASSEMBLY AND COVERING

To check the incidence of each component, I installed the wing and the horizontal stabilizer before covering. When I was satisfied with the setup, I CA'd them into place. Before I ironed the covering into place, I used Coverite* Balsarite to coat the areas that come in contact with fuel or exhaust. Having completed the covering, I hinged the elevator, the rudder and the ailerons. I floated decals into place with window-cleaning solution and then squeegeed them down.

EQUIPMENT INSTALLATION

Make sure there's enough room for foam padding, and drill holes for the fuel tank right through the wing's leading edge. The sheath for the throttle cable runs along the inside edge of the tank. Servo installation

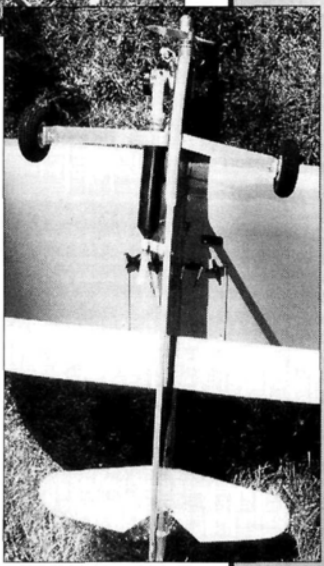
SPECIFICATIONS

Model name: Gee-whiz-Bee
Type: sport fun fly
Manufacturer: Morris Hobbies
List price: $84.95 (plane kit), $224.95 (plane and MVVS 40 combo)
Wingspan: 52 in.
Wing area: 775 sq. in.
Fuselage area: 500 sq. in.
Length: 44 in.
Weight: 4 to 5 lb.
Wing loading: 14.9 oz./sq. ft.
Engine req'd: .40-size ABC Sport
Number of channels req'd: 4 (aileron, elevator, rudder, throttle)
Airfoil type: thick symmetrical
Wing construction: built-up balsa rib and spar
Fuselage construction: built-up balsa stick, sheeting and lite-ply doubler
Features: all-wood construction, aluminum landing gear, decals.

Hits
- Excellent instructions.
- High-quality wood and other materials.
- Predictable handling.
- Strong design.

Misses
- Sketchy instructions on pull/pull cable installation.

completed the right wing; the other wing contains a foam-wrapped battery and radio receiver, a switch and charging bracket and two servos. I made the pull/pull cables according to the instructions. Because I didn't correctly position the exit for these sheaths, I had to reverse the elevator cables. I could just about make the 45-degree up-and-down requirement for elevator movement. Had I given a little more forethought to the cable installation, I could have avoided this problem.



The business end of the plane shows the engine and pipe installation.

This underside strut shows the radio/servo layout and the MVVS muffler setup attachment.

• **Engine.** With the engine installed on the test stand, I assembled the one-piece header along with the tuned muffler and mounting bracket. I removed the glow plug and checked it as well as engine rotation. The engine displayed that nice "clicky" feeling around the top of the stroke, and that indicated a good piston-to-liner fit. The engine started on the first flip. I advanced the throttle to 3⁄4 and, to achieve a fairly rich 2-stroke sound, I adjusted the needle. Although I spent a lot of time at full power during the first tank, I cycled the throttle every few seconds to vary the heat input. After about 30 ounces of fuel had been consumed, I leaned out the mixture. The tachometer read just under 15,000rpm. Throttle response was fantastic. I burned 10 more ounces of fuel. The engine reached a little more than 15,000rpm. I cut 1⁄4 inch off the header pipe, and the engine reached 15,800rpm, and the idle was solid at 2,500rpm.

• **Balancing and setup.** I balanced the model right in the middle of the center-of-gravity range, which lies approximately between 4 and 4 3⁄4 inch back from the leading edge. I set ailerons and elevator to have about 45 degrees of travel up and down. When I asked Tony Ayer about rudder deflection, he said, "All you can get." He also advised that I mix in flaperons to elevator at about 25 percent.

CONCLUSION

The Gee-whiz-Bee certainly drew a lot of attention at the field. Just about everything else that was going on in the pits stopped while it flew. With its slow, highly maneuverable flight capabilities, the plane can perform some astounding aerobatics.

**Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

FLIGHT PERFORMANCE

The extra care taken to ensure a straight wing and fuse paid off; no trim adjustments were necessary for true flight. The only exception was a slight re-trimming of the flaperons to limit drag. I did this with the radio's flap knob. I did find that exponential on ailerons and elevator was not necessary; the plane actually felt more positive with full throws right from the start.

• Takeoff and landing

As long as you start into the wind or directly downwind, you'll have no problem on takeoff. You can jump off the ground with a surge of power or fly off like a trainer. If you have a crosswind, the large side area can be detrimental during long takeoff runs. It isn't so much a problem in landing because you can adjust an approach and make it almost vertically into the wind. The plane is easy to maneuver, and I floated into a three-point, no-rollout landing on my first try. Landing approaches can be enhanced to near vertical descent by programming flaperons to act as spoilers and mixing them with the throttle.

• Low-speed performance

Because its thick airfoil provides a great deal of lift and drag, the Gee-whiz-Bee can fly very slowly. Stalls are crisp and predictable, but crosswind conditions can make them tricky. Because of the large side area's ability to block airflow, if you are in a crosswind, the downwind wing will drop quickly. Usually, recovery can be made with little altitude loss by neutralizing the elevator and applying power.

• High-speed performance

Some short, high-speed runs showed no surface flutter. I don't, however, recommend prolonged high speeds. High-speed flutter of the Gee-whiz-Bee's large control surfaces would certainly lead to high-speed crashes (which is also true of other fun-fly planes). This plane is most fun when performing close-in, low-speed aerobatics anyway. Climb-outs with the MVVS engine installed are effortless.

• Aerobatics

The roll rate at the prescribed settings is quick but not scary; rolls are pretty axial. Loops can be large, smooth, picturesque affairs or something akin to a Chihuahua doing a back flip. The first one I tried was more like the latter; the nose came up abruptly, and the plane just sort of flopped over—not very gracefully. Inverted flight required a little down-elevator, but there was plenty to spare for inverted aerobatics. The rudder has all the clout you could ever want. I made some very flat, control-line-like turns with about 1⁄3 rudder and no aileron input. Beyond 1⁄2 throw, the rudder induces some roll. Knife-edge is easy; just do a 1⁄4 roll and crank in some rudder; it will stay in knife-edge all day. I still need some practice with the knife-edge loop, but I did perform some short-radius ones by slowing in vertical, cranking in lots of rudder and increasing throttle. Tumbling maneuvers can be accomplished by providing just about any full-throw combination of controls. All the spinning maneuvers are possible with standard control inputs. I was successful at hovering, about three mistakes high. I entered the maneuver just like a landing approach by slowing down while feeding in up-elevator until the plane was vertical. At that point, the throttle controls up-and-down and the rudder side-to-side movement. The plane hovers better with 2 degrees of right thrust in the engine. Tail slides and tail-first landings are possible, but I need a lot more stick time before I attempt them.

PRODUCT REVIEW

Alarm and locater in one unit

by ROGER POST JR.

JR Remote Control* has come up with a great device that can save your model. The NEB-480 Model Beacon and Locator tells you whether your battery pack has enough voltage left in it to power your R/C system. I'm sure you've often wondered: "Do I have enough battery power left for another flight?" (Notice I say, "another flight"; we never say "one more flight," right?) The NEB-480 has an audible alarm and an LED readout that warns you of impending doom.

Here's how it works: plug the NEB-480 into a gear, flap or auxiliary channel that you aren't using. Then install the face of the NEB-480 in the cockpit instrument panel or somewhere where it's visible. When you turn on the radio, you'll hear a beep for 2 seconds. At the same time, the LED will display a green light, a green and a red light, or a red light, depending on the voltage left in the battery pack. If the alarm doesn't stop beeping, then it *isn't* safe to fly.

The other great feature of the NEB-480 is that it can help you locate your plane if you lose sight of it when it goes down. All you do is walk toward the plane and, when you think you're near it, hit the switch on your transmitter that corresponds with where you plugged in the NEB-480. An 80dB alarm will sound continuously to help you locate your plane. It can be heard from several hundred feet away as long as the battery hasn't come unplugged in the crash or any other part of the system has been damaged. You can also "blip" the switch quickly and listen for the alarm—a method that I recommend if you think that your battery is low. This is a very handy feature when you're walking in woods, cornfields, tall grass and hay fields looking for your plane.

JR REMOTE CONTROL
NEB-480 BEACON

The NEB-480 can be used with JR, Futaba*, Hitec* and Airtronics* (polarity correction needed) radios. It's compatible with 4.8V systems—not with 6V systems.

The NEB-480 is a worthwhile investment, and the list price of $49.95 is a small price to pay to save your model. I use mine all the time, and it saved my Goldberg* Ultimate biplane one day.

SPECIFICATIONS

Operating voltage: 4 cells, 4.8 volts
Current consumption: 27mAh (54mAh when alarm is active)
Alarm level: 80dB+
Weight: 11 grams
Size: $1\frac{1}{2}$x$\frac{7}{8}$x$1\frac{1}{16}$ in.

Battery checker

Voltage	LED	Audible alarm
5.2V or higher	Green	No (OK to fly)
5.2 to 4.4V	Green/red	No (OK to fly)
4.3V or less	Red	Yes (recharge battery)

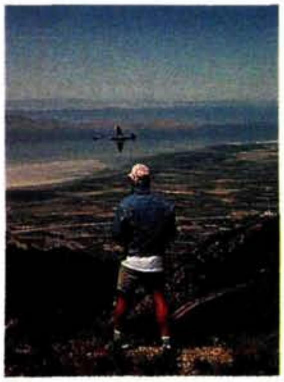
Features: compact, lightweight and can be installed in most planes and helicopters.

**Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

Pete Marshall flies his Slope Scale* Spitfire at Francis Peak, which overlooks Great Salt Lake.

Art Boysen's Krause ASW-27 flies at Francis Peak with Great Salt Lake in the background.

Soar Utah



by JOE CHOVAN

"GO WEST," came the call on America Online's R/C soaring message board. "There's great soaring in Utah!"

Well, as a fledgling sailplane pilot from the East who was eager to see some awesome scenery, meet nice folks and sample great slope flying, I accepted the invitation, as did 65 other pilots who hailed from Vancouver to Florida.

This was the first sailplane meet of this magnitude hosted by the Intermountain Silent Flyers (IMSF). It was held from July 21 to 23 at Point of the Mountain, about 10 miles south of Salt Lake City.

The itinerary: "Flung whatcha brung" on Friday; Scale/PSS soaring event by day and static judging at night on Saturday; the cross-country event on Sunday; and a fun-fly excursion to Francis Peak (less than an hour north of Salt Lake City) on Monday.

THE SIGHTS AND SITES

Navigating around Salt Lake City was rather easy for us after we became accustomed to the fact that streets don't have names; they have numbers.

Over-the-edge competition at Point of the Mountain

Once we learned the system and recognized the landmarks—Point of the Mountain, Lake Utah, Great Salt Lake, the huge, open-pit copper mine—we just pointed our minivan loaded with planes and went!

As sailplane guru Dave Garwood has noted, slope fliers are always looking out the car window for possible sites. When I first arrived in Salt Lake City, I didn't realize the reach of the valley (actually the Uinta Basin). I scanned the horizon and saw towering mountains everywhere, but they were so *far away*! Such terrain—a large, low-lying area that abruptly slopes upward—lends itself well to slope soaring. The numerous ski resorts in the Wasatch Mountain range give evidence that these hills are accessible.

PHOTOS BY DAVE GARWOOD & JOE CHOVAN

David Nash's MiG-15 and P-51 Mustang (original designs).

Point of the Mountain rises in the path of winds that blow north or south on the valley's eastern edge. In the morning, we flew the southern face and sometimes switched to the northern face when the winds changed direction in the afternoon.

I can't overemphasize the scale of the terrain that we're dealing with when standing on the Point. The view spans more than 50 miles, and there is a 500-foot grade to the base of the hill. We could walk all the way to the bottom on nearly all faces. This afforded a certain peace of mind, knowing that not only could I see the bottom, but also the way to the bottom if a plane went down. It also made large diving maneuvers visible close to the edge, because the lip of the hill did not obscure the pilot's view.

It's a bird...and a plane! John Raley of Costa Mesa, CA, brought his replica of a bald eagle—originally a UK design. The top of the wing, which sports detailed feathers, took 6 months to complete.

Brian Laird's Slope Scale ME-109 PSS

Landing at Point of the Mountain was also rather easy, because there is a large flat area on top behind both the north and south ridges, with very little rotor to contend with on approach. The north ridge has a secondary hill that rises 400 feet from the flat landing zone. Planes could be high-started from the bottom and then coaxed up into the secondary ridge lift, or flown from the lower north face and then "transitioned."

Francis Peak is even more spectacular. We flew from nearly its 10,000-foot summit, looking down its wide green rifts. There are several small outcroppings on which to sit or stand near the top, allowing a panoramic view of neighboring peaks and the valley floor 5,000 feet below.

NEW TRICKS

At this mecca for slope soarers, I discovered some interesting methods and gadgets used by creative minds in this corner of R/C flight.

• **A better stall turn.** Here's a technique used by full-scale aerobatic glider pilots that can be mimicked by R/C pilots of the model counterparts. Carl Bice of Lakeworth, FL, tells us, "When rising up to do your stall turn, touch the rudder softly in the direction opposite of your intended turn, then kick it over hard the other way as you reach the top." This gives a little boost in a "pendulum effect," which helps to compensate for not having a propwash over the tail surfaces like

David Nash launches Art Boysen's Krause ASW-27 from the south side of Point of the Mountain.

power planes do. This way, a simple stall turn can become more of a "hammerhead."

• **Have a "weak link."** Save your wing mount by using 4-40 nylon bolts to fasten the wing to the fuse. This works well with wing mounts that allow a "breakaway feature." (The wing fairing and frontal attachment do not impede this action, and aileron torque rods are not huge obstacles to a clean separation.) If a wingtip hits first in a crash, the bolts snap, yet are still strong enough to take the flight stresses of most highly loaded fast ships. When you're hours away from your shop, it's much easier to replace some bolts than to re-assemble a shattered wing mount.

Long-time fliers/craftsmen such as Carl Bice, Doug Buchanan and Fred Mallett agree with this sound advice.

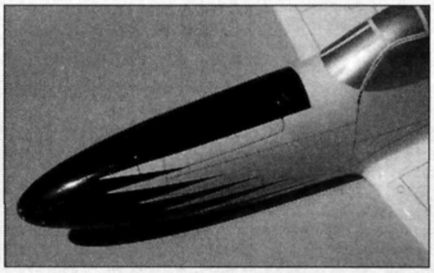
• **UV protection.** Want your freshly glassed and finished wings to stay looking new, despite prolonged exposure to the sun? Mike McKeown of Performance Composites* suggests applying three coats of a good car wax (carnuba-based is fine). He showed me a Starling wing that was more than a year old and had been treated with a popular brand of car wax that looked like the wings in his new kits. Mike recommends clear wax because some preparations have a green tint and, if applied over a light color, they may highlight imperfections in the finish.

• **Wind meter.** Steve Hinderks of the Birdworks* in Port Orford, OR, demonstrated a great little mechanical/electronic wind meter. The "SkyMate" measures $^1/_2$x$^1/_2$x$^3/_8$ inches, comes with a lithium battery and is waterproof. This Swiss-made marvel has a tiny impeller mounted on sapphire bearings and a magnetic field pick-up to the circuit that allows the impeller to spin *very* freely. With a gentle squeeze, this device measures wind speeds of from 1 to 99mph. An LCD display shows the results. The unit sells for $79 from Into The Wind*.

CONTEST RESULTS

The 25 pilots who entered the contest

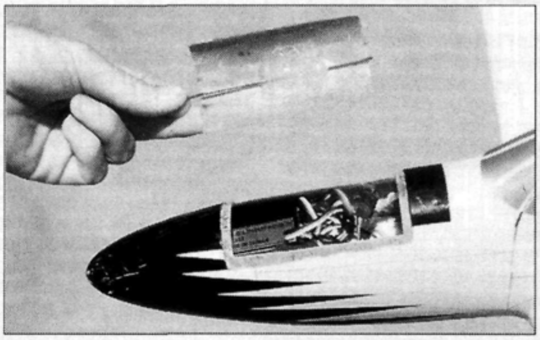
HOW TO: "THE BRIAN LAIRD METHOD" FOR A SUPER-SLICK HATCH



Suppose you have a glassed fuse that is really strong, with a nicely rounded nose and eye-pleasing, flowing curves. Alas, to mount and service your gear, you need to cut the hatch. If you're like me, the last thing you want to do is cut an ugly opening and screw or latch the ill-fitting cover into place.

The following method yields a nearly imperceptible, clean perimeter joint, and you can remove the hatch without tools. All that you need for this project is an access hole from the wing mount or cockpit area, some clear cellophane packing tape, resin, fiberglass, a short length of music wire and a dab of silicone-type adhesive.

1 Cut a hatch using your favorite tool(s). You don't want to change the original fuse contour too much when you replace the hatch. Try to get the opening reasonably straight, and keep in mind that, on a typical curved fuse, removing material from the side edges will lower the hatch height slightly, depending on the contour and size of the hatch. You will be replacing the hatch and re-glassing it into place.



2 Apply cellophane packing tape (the really thin stuff) all around the edges of the hatch and its surfaces. This tape will be the "release agent" in the next steps, so make sure there are no gaps in the tape seal and that the tape seams are smooth.

3 Tape the hatch into position against the forward edge of the opening. This will open a gap that is larger at the rear edge of the hatch, but that's fine. Stretch the tape well over the hatch so it bridges all gaps smoothly. You are going to fill these gaps (from the inside) with resin in the next steps.

4 Now, if your fuse is polyester-resin, you *must* use polyester-resin. If it is epoxy, then use that. You don't want to have chemical incompatibility problems, because the resin needs to adhere well to the fuse. From the inside, apply glass cloth and resin liberally to the entire hatch area, using the wing-root access hole to reach the nose area. You don't have to be very neat, just make sure you overlap the edges well and "wet" all gap areas with resin and cover them with cloth.

5 Let the resin cure, then remove the tape, and the hatch should come out with little effort (the tape-release agent allows this).

6 You should have a "membrane" of fiberglass cloth and hardened resin spanning the hatch opening and a ridge left by the removal of the hatch. Now, simply cut an opening in this membrane, and leave a border wide enough to support your hatch.

7 Remove the tape on your hatch and, with a generous dab of silicone glue, affix a piece of music wire that's slightly longer than the hatch to the center of the underside of the hatch, and allow it to dry.

8 Mount the hatch by positioning the wire under the lip of the "membrane," and sliding the wire so that it clears the "membrane" on the opposite side. Then flex the wire down under this side, and slide the hatch into position. It should fit very well, and the only gap left should be the thickness of the cellophane tape release that you removed!

9 Finish-sand the nose to a perfect contour, prime and paint!

10 To remove the hatch, slightly pinch the sides of the hatch, so you can raise a front or rear hatch edge above the lip, and then slide the edge above it until the wire under the opposite end clears.

were tasked with a short flight, which was judged for smoothness and precision. Later that evening, points were added during the static competition and to those tallied from a "people's choice" ballot. The trophy winners were: first place—Gary Brokaw with his Bergfalke 1 (plans available from Bob Holman*); second place—Ed Mason with his original design, scratch-built ASW-17; and third place—Fred Mallett flying his PSS Beechcraft (an original design).

Sunday's cross-country thermal event saw four pilots trying to get down the hill, out to the turnaround point and back up the hill while keeping their planes aloft as they rode in the back of a pickup truck. This presented several challenges to the contestants, possibly the most difficult of which was keeping steady thumbs (and seats!) while the truck negotiated the unpaved and often bumpy route. George Voss emerged the victor, flying a Larry Jolly Model Products* Comet. Fred Mallett took second with his Salto, which has a Viking Models* fuselage and original carbon-fiber wings. Arlie Stoner placed third, also with a Comet, and Jim DeRubeis earned fourth with a C.R. Aircraft Models* Climmax.

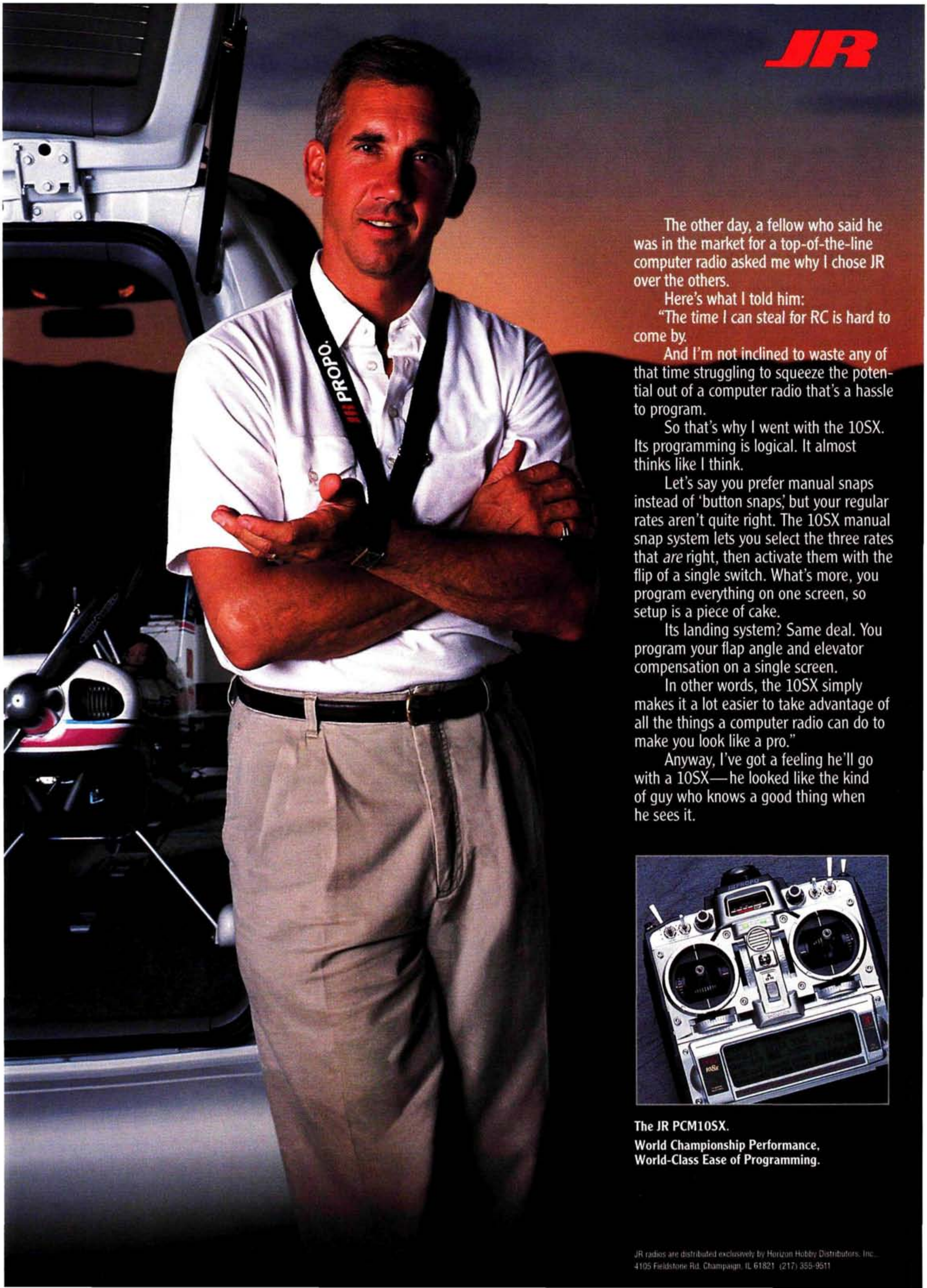
Gary Brokaw's Austria (built from Bob Holman plans*), nicknamed the "Elephant," was a real crowd-pleaser. Designed in 1931, the full-scale sailplane was one of the first to have trailing-edge camber control designed to change flight speed.

Steve Hinderks was awarded the Pilot's Choice Award in scale for his giant model albatross. It's quite a model and achievement from quite an innovator.

I'm looking forward to another great summer venture in the west. How about Soar Utah '96, anyone? Have sunscreen, planes and vacation time—will travel!

** Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

SPONSORS	
Airtronics Inc.	Performance Composites
The Birdworks	RC Soaring Digest
CAB Designs	Slegers International
California Soaring Products	Taucom
Hitec/RCD	Soaring Specialties
JR Remote Control	TLC Hobby and Ceramics
Major Hobby	Torque & Recoil Club
MRS Hobbies	Viking Models
Northeast Sailplane Products	Vision Hobbies
	Windspeil


JR
PROPO.
The other day, a fellow who said he was in the market for a top-of-the-line computer radio asked me why I chose JR over the others.
Here's what I told him:
"The time I can steal for RC is hard to come by.
And I'm not inclined to waste any of that time struggling to squeeze the potential out of a computer radio that's a hassle to program.
So that's why I went with the 10SX. Its programming is logical. It almost thinks like I think.
Let's say you prefer manual snaps instead of 'button snaps,' but your regular rates aren't quite right. The 10SX manual snap system lets you select the three rates that *are* right, then activate them with the flip of a single switch. What's more, you program everything on one screen, so setup is a piece of cake.
Its landing system? Same deal. You program your flap angle and elevator compensation on a single screen.
In other words, the 10SX simply makes it a lot easier to take advantage of all the things a computer radio can do to make you look like a pro."
Anyway, I've got a feeling he'll go with a 10SX—he looked like the kind of guy who knows a good thing when he sees it.
The JR PCM10SX.
World Championship Performance, World-Class Ease of Programming.
JR radios are distributed exclusively by Horizon Hobby Distributors, Inc., 4105 Fieldstone Rd. Champaign, IL 61821 (217) 355-9511

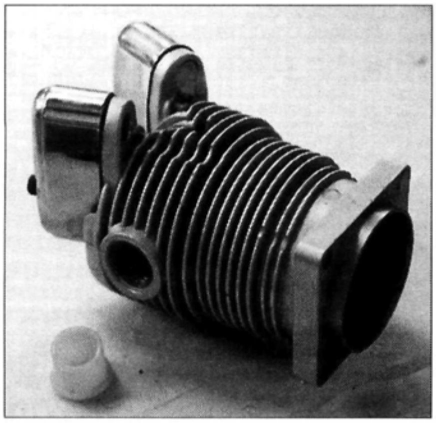
HOW TO

Cast your own round engines

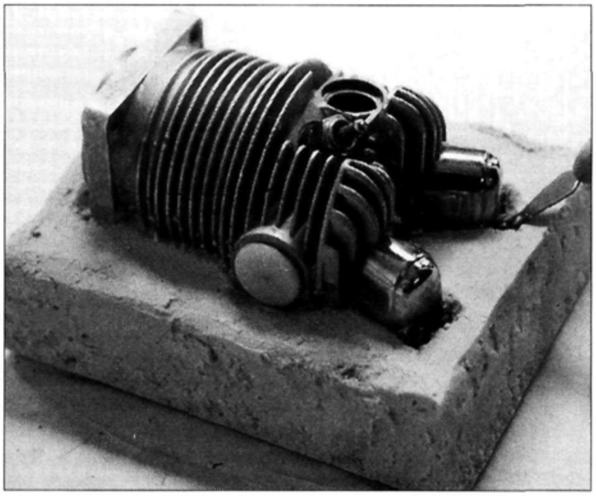
by CARL S. DIEHL

Resin Radials

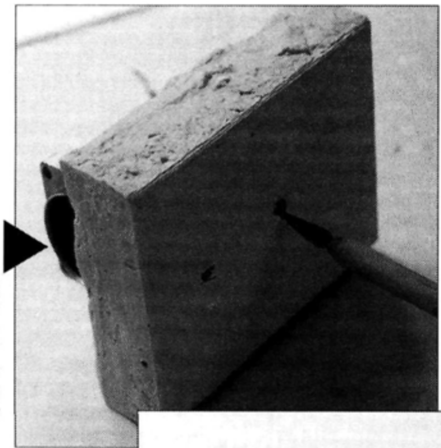
My newest scale model is a Pica/Robbe* Waco Bipe. I wanted to do a good job because I planned to take it to the annual Gator Shootout. A scale, dummy radial engine was a must, so I decided to resin-cast one. Saito* 4-stroke engines have very realistic one-piece cylinders and head castings that make good "generic" cylinders for round engines. It's relatively simple to resin-cast copies of the Saito "jug" and then use them to make 3-, 5-, 7- and 9-cylinder dummy engines. Here's how I did it.



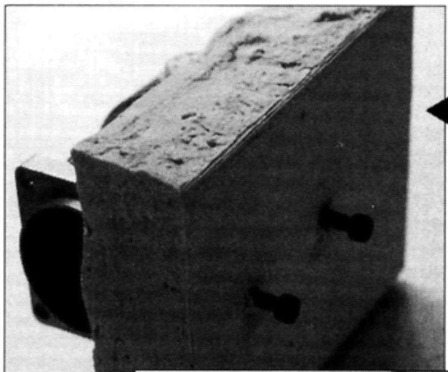
1 Before a casting can be made, the cylinder openings need to be plugged. I used wooden dowels to seal the pushrod holes and the cylinder base holes. I used a plastic cap plug (from the junk box) to seal the exhaust opening.



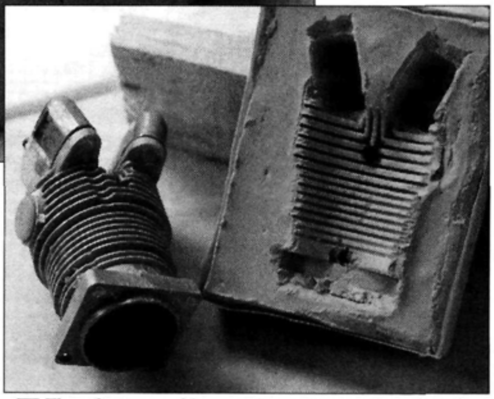
2 Next, I made a female mold of the cylinder with Bondex plaster of Paris (available from art-supply stores). I cleaned the plaster away from the rocker-arm cover bolts prior to removal. Notice that a little less than half of the cylinder is embedded in the plaster.



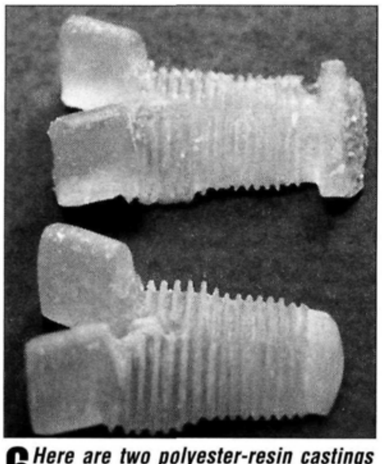
3 Clean out holes in the back of the plaster mold so you can insert ⅛-inch-diameter "knock-out bolts." These holes should be located over the original Saito ejector-pin holes for their cylinder casting.



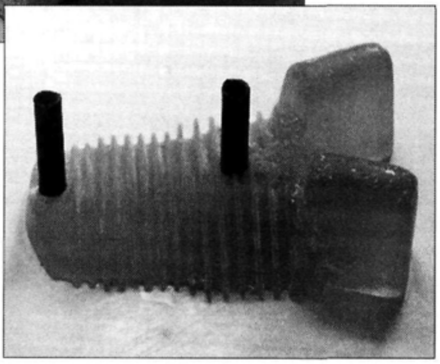
4 Insert some old bolts in the holes, and tap them lightly with a small hammer to force the Saito cylinder out of the mold.



5 The plaster mold reproduces the surface detail of the Saito cylinder exactly. For a more accurate full-size engine look, I cleaned up the fin depressions in the mold.



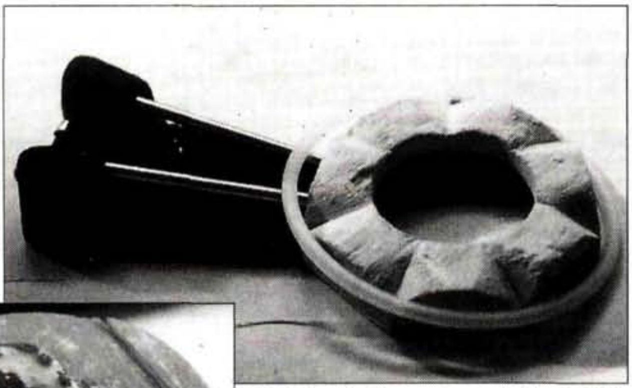
6 Here are two polyester-resin castings that were made using the plaster mold: the one in the background is as it came out of the mold; the one in the foreground has been cleaned up, and the base (which is no longer needed) has been removed.



7 Next, use the cleaned-up resin cylinder (with ejector-pin tubes installed) to produce a second-generation mold. Before you make the new female mold, the cylinder must be waxed and coated with mold release (PVA). Notice that the master cylinder is glued to a flat, smooth back piece. The ejector-pin tubes serve the same function as the holes in the original plaster mold.

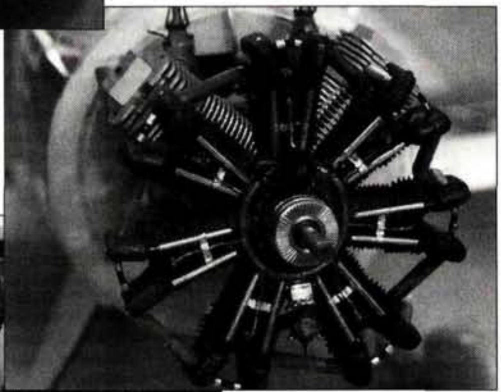
8 The second mold (shown here with master cylinder removed) is also made of polyester-resin. A dam is built around the master, and the resin for the mold is poured over it and allowed to cure. To prevent cracking, mix the resin so that it cures slowly.

It's relatively simple to resin-cast copies of the Saito "jug" and then use them to make 3-, 5-, 7- and 9-cylinder dummy engines.

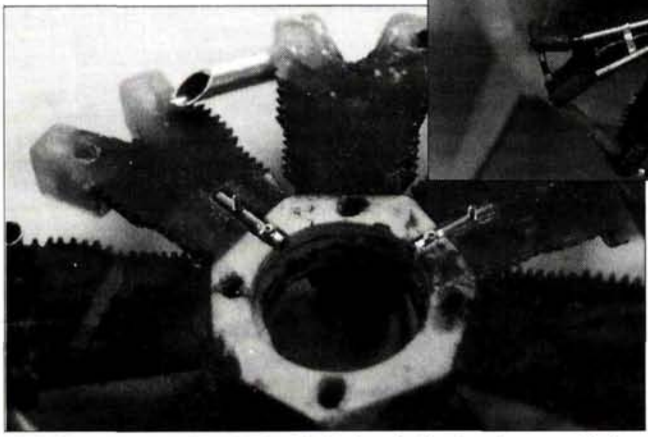


10 *I made the crankcase hub out of ½-inch balsa and added a ¼-inch-ply backplate for strength. Here, the first finished and detailed cylinder (notice pushrod tubes and spark-plug detail) has been set in position and glued to the hub. The ignition-wire ring is made of plastic tubing.*

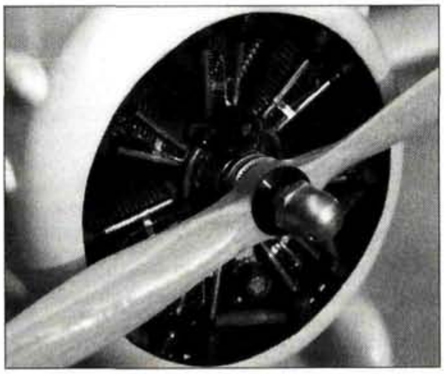
9 *Resin that will form the cylinder for my dummy engine has been poured into the new mold. Wax and PVA are also required inside the mold so that the new castings can be removed. After repeating this process seven times, I have enough cylinders for my dummy radial engine.*



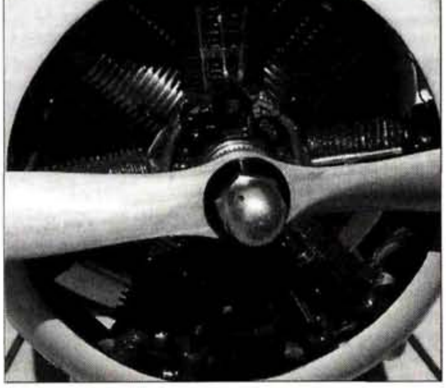
12 *The completed dummy radial is in place on my ⅕-scale Pica/Robbe Waco Bipe. As you can see, the removable cylinders are still in place and cover the Laser engine nicely.*



11 *For proper cooling during flight, I made the two dummy cylinders that were in line with my Laser 200 engine's cylinders removable. This rear view of the radial engine shows the brass tubes and screws that are attached to the removable cylinders. One buttonhead screw holds each cylinder in place.*



13 *With the radial installed in the cowl, the model looks great, and the Laser engine is completely out of sight. The dummy engine is simply glued to the inside of the cowl with Zap-a-Dap-a-Goo*.*



14 *The two removable cylinders have been removed for flight. The cylinders for the Laser 200 can just be seen. Cooling has been very efficient with this setup.*

* Addresses are listed alphabetically in the Index of Manufacturers on page 146. ■

CENTER ON LIFT

MICHAEL LACHOWSKI

UNDERSTANDING HIGH-TECH SOARING TECHNIQUES

I WANT TO TALK about some of the leading-edge technology used in soaring. All this technology can bewilder the average pilot. Fortunately, things are being done to make it more understandable. First is Soaring Stuff's* excellent videotape on hollow-composite construction. The techniques aren't too difficult, and the results are beautiful. Next is Don Edberg's book on Futaba* computer radios. He does an excellent job of explaining all the mixing options you might explore with a six-servo model. I'll also discuss control setups with computer radios and some pitfalls you might experience if you rely too heavily on their programmability and ignore the mechanics of your control linkages.

CONSTRUCTION VIDEO

Fred McClung, assisted by Taylor Collins of Soaring Stuff, has put together an excellent tutorial on the basics of hollow-core-composite construction—"Building Hollow Composite Aircraft Structures." I've seen Fred's handiwork, and he produces very nice models. In the video, you'll see that the skills and techniques required are not much different from what you need to vacuum-bag a model. Of course, the completed hollow-core-composite models can be reproduced and have excellent surface finishes. You don't see any of the surface waviness you usually get with a bagged model.

Fred demonstrates the techniques used to build the molds using a "master." He uses tooling epoxy and a sand-and-epoxy mix to build the mold. The video covers the simple but key details necessary to prepare the master for mold making and the mold details that are necessary for proper trimming and alignment. Fred then uses this mold to show the layup steps necessary to produce the skins on the wing or the tail. He uses a vacuum bag to hold the skins in the mold. When the skins have cured, they must be trimmed before they're joined. The trimming techniques Fred uses are simple and easy to master.

The most complex step is installing the interior structure before joining the skins. The interior must fit properly, and Fred shows how to keep it in place and properly measure dimensions. Finally, he joins the skins to complete the structure. The only steps that remain are to pop the parts out of the mold and trim off any flashing that's around the edges.

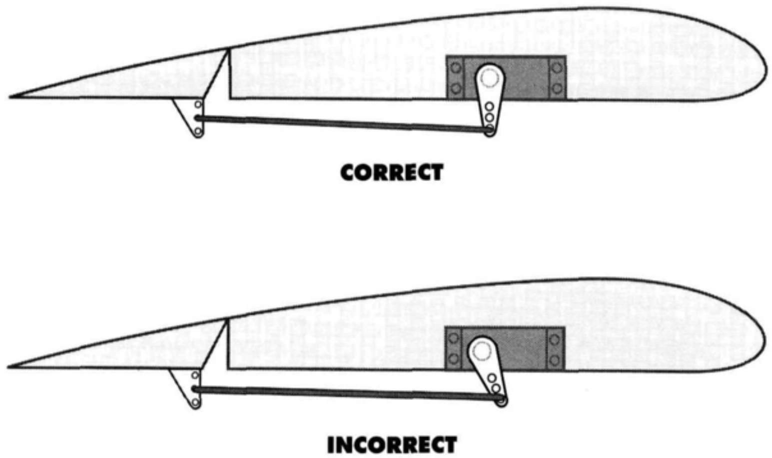
If you're interested in exploring molding techniques, you'll want to get this video and the Soartech 10 video, and you'll be well on your way to understanding this not-so-mysterious construction technique.

PROGRAMMING THE FUTABA SUPER 7

Most computer programming guides that come from the computer radio manufacturer are inadequate. They often cover aircraft, helicopters and sailplanes all in one guide and focus mainly on menus and options rather than practical applications. You can usually buy books that do a much better job of explaining how to use most computer software. Don Edberg has written a guide for the Futaba Super 7 radio systems.

The seven chapters and 91 pages of the guide include step-by-step instructions and examples for programming the 7UAFS/PS and 7UGFS radios for sailplanes. If you're a power flier, you'll also enjoy some of the other programming chapters. There is also a clear description of sailplane mixing and some trimming charts with lists of tests and adjustments you might make to take advantage of your radio.

Even if you don't own a Futaba radio, you'll find chapter 5 extremely useful. It explains all the mixing techniques available in most glider-capable radios. Many pilots don't take full advantage of mixing ailerons with flaps or using full-

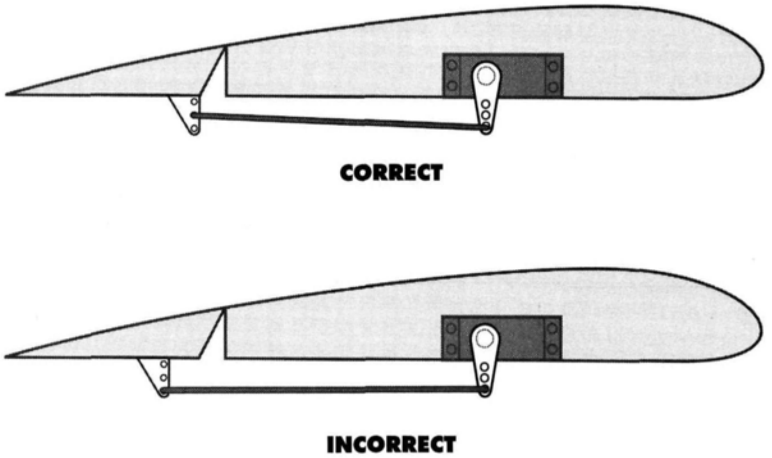


If your servo arms are not set the same (when the flaps are in the up position), you will get an uneven deflection of the flap surfaces when they are lowered. Set up your servos so everything matches.

span camber changes. This book explains why you might want to use these mixes. Don's "Sailplane Trimming Chart" is very helpful. It explains 10 flight tests that you can use to adjust the mix rates, throws and mode settings on your model.

If you own a Futaba 7UAFS/PS or 7UGFS, the $10 (plus $2 S&H) for this book is well worth it. Even if you don't own one of these radios, but you want to learn more about sailplane mixes and computer radio programming, you'll enjoy this book.

Write to Dynamic Modelling Super 7 Book, 4922 Rochelle Ave., Irvine, CA 92714-2941; (714) 552-1812.



Control-horn installation can cause problems, too. The linkage should connect to the same hole in the control horn, and the horn should be the same distance from the hinge line.

RADIO INSTALLATIONS AND SERVO SETUP

Computer radios provide many features to fine-tune control setups on sailplanes. These features are intended for fine-tuning and are no substitute for proper control-horn and servo installations. I have seen a number of poor radio installations in which servo centering and servo travel adjustments have been used improperly. This results in poor control response in some directions or unintended directional changes at intermediate control inputs. It's frustrating to set your flaps to travel the same amount at full throw then see a difference in angle at your launch preset position.

Servo arms rotate on an axis. When this rotational motion translates into linear travel on the pushrod, the linear motion of the pushrod (for a given amount of rotation) is different for each servo arm position. You get more throw when the servo arm is 90 degrees from the pushrod than when it is 45 degrees from it. Let's assume that the control horn installations on the two flaps are in the same position relative to the hinge line, and they are of the same length. Now look at the servo neutral positions on both flap servos. Are they at the same angle relative to the output shaft? If they're different, the motion of the flaps will differ through the intermediate positions, and you might even have to adjust the servo travel limits on one servo to match the flaps at the maximum travel position.

To fix this, adjust the flap servos so that they have nearly the same angle relative to the shaft, and mechanically adjust the linkage to center the flaps. If things are just right, you should be able to set the flaps in several positions, and they should line up with each other. Also, the travel limits should be identical.

Control-horn installation can cause problems, too. Measure the position of the hole in the horn relative to the hinge line. The hole should be the same distance below the flap and the same distance from the hinge line. Differences here will also show up as flap misalignment in intermediate control-surface travel positions.

Don't depend on sight to measure the travels; use a ruler. You can record the travels as well as your radio program settings.

Servo centers can also have an impact on some mixes. The most common place is aileron-to-flap mixing in which a percentage of the aileron travel mixes with the flaps, and that moves the entire trailing edge for turns. Thirty-three percent is a good starting point. Excessive settings on flap servo centers can have an impact on these programs. If the center begins too close to the limits of the servo travel, the servo may not move the flap up with the aileron. I experienced this problem with an Airtronics* Vision, which previously didn't have the mix.

The solution is to readjust the centers so that the center value has the opposite sign and to readjust the linkages. Now the flaps will travel upward. In JR* radios, you must set the servo centers somewhere around -110. The purpose of center setting is to allow maximum travel on the servo. Because the travel limit is actually -150, you can usually set the value only to -125 so that there is still some travel available. This still may not be enough travel for the desired flap deflection. For larger aileron mixes, the center may have to be set to something less than -100.

Now you can get out your ruler and measure those deflections to see whether they're equal. Adjust those program settings, and check your linkages. See you next month.

**Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

FIELD & BENCH REVIEW

ALTECH MARKETING Tamecat

TOP GUN TRAINER

by VIC OLIVETT

WHEN I opened the box from Altech*, I couldn't believe that this plane was a trainer. It looks more like a fast jet. The workmanship is great. The construction is a little different, and the kit has only eight major components. The wing cores have been sheeted and sanded; the fuse comes in two parts—the front half and the rear, which is slotted for the tail feathers. The cockpit is made of ABS plastic and is held in place by a pin in the front and a rubber band in the rear. The kit comes with all the hardware you will need. The landing gear is strong—just what's needed for beginners.

CONSTRUCTION

• **Tail.** Both the vertical and horizontal fins have tabs that fit into the slots on the rear of the fuselage. The vertical fin must fit snugly and, when viewed from the back of the plane, both fins must be perpendicular to the fuselage. Also, check the fit of the two rudders and the slots for the hinges. Both rudders are functional, so make sure they clear the fuselage at the bottom of the fins.

The next step is to install the horizontal stabs. Again, make sure the tabs are snug and the surfaces are aligned properly.

PHOTOS BY VIC OLIVETT & CHRIS CHIANELLI

• **Fuselage.** Mark the center, and then drill the 5/64-inch holes in the four corners of the radio compartment cover. Measure and mark the hole locations for the dowels, mark the locations on each corner of the cover, and then drill an 1/8-inch hole where you made the marks.

Install the landing gear, then mark and

SPECIFICATIONS

Model name: F-14 Tamecat Trainer
Type: trainer (fun trainer)
Manufacturer: Altech Marketing
Wingspan: 68 in.
Length: 50¼ in.
Wing area: 835 sq. in.
Weight: 5½ to 6½ lb.
No. of channels req'd: 4
Engine req'd: .40 to .60 2-stroke; .53 to .80 4-stroke (Altech recommends engines no larger than a .40 2-stroke or a .53 4-stroke for flight training.)
Engine used: Enya .45 CX 2-stroke with APC 11x7 prop
List price: $179.98
Features: balsa-sheeted, foam-and-ply construction; pre-sheeted and sanded components; ABS plastic parts; flat-bottom airfoil with a wide chord; wide landing gear for solid ground handling.

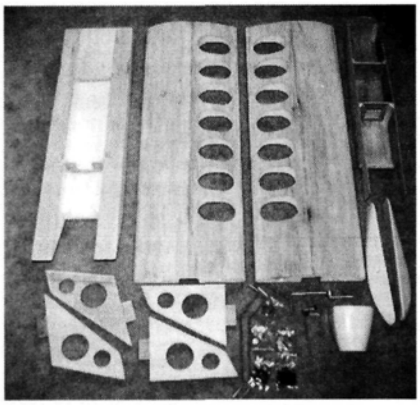
Hits
- Easy and fast construction.
- Well-written and -illustrated manual.
- Excellent flight characteristics.

Misses
- None.

drill the $^5\!/_{64}$-inch holes for the hold-down straps in the eight locations shown. Remove the gear for now. The nose gear uses two nylon bearings mounted on the forward bulkhead. Use the gear wire to align the two bearings, and fasten them in place with the screws and bolts provided in the hardware package. Then remove the nose gear.

Check the fit of the front half of the fuselage to the rear half several times. If you position the sides of the front half flush with the top of the rear half, the front half will angle downward by 3 degrees. Mark the rear and sides of the front section for reference and, when you're satisfied with the fit, glue them together with epoxy.

Wipe off the excess epoxy with paper towels and alcohol, and let the epoxy cure. Install the 13-inch, wing hold-down dowels through the fuse bulkheads. The dowels should extend the same distance past the front and rear bulkheads. Slow Zap and kicker work well for this step. Use the same procedure for the four cowl-mounting blocks on the firewall.

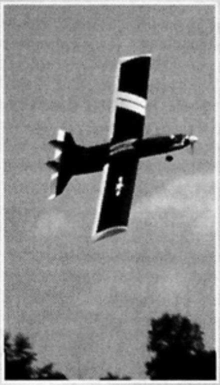


The contents of the Tamecat kit—not many parts to assemble.

FLIGHT PERFORMANCE

• Takeoff and landing

With its wide-stance landing gear, the Tamecat handles very well—even on grass fields. The steering is positive and crisp. All the surfaces were set at neutral. At full throttle, the Tamecat tracks straight down the center of the runway. With just a touch of up, the liftoff was smooth and steady with no bad habits. When it's in the air, you know you have a winner. For the duration of the first flight, absolutely no trim changes were needed.



The Tamecat lands as well as any trainer I've seen. The lineup is easy, and descent is steady and predictable. Once in ground effect, the Tamecat just floats about a foot off the ground and then slows down to a crawl. This is perfect for beginners.

• Low-speed flight

Going fast or slow, its flight characteristics are the same. I tried to get this plane to stall. I even tried a steep turn at very low speed—a perfect setup for a stall...yeah, right! It just doesn't happen. The most fun I had with the Tamecat was on a windy day. With a 15mph wind blowing straight down the runway, you can do a perfect imitation of a Harrier. That's right; with a little practice, I have done several landings with no rollout. On a calm day, I took off, climbed to about 100 feet and set the trims for a big circle over the field. I then set the transmitter down, sat in a chair for five complete circles, then remembered I was supposed to be flying this thing!

• High-speed flight

With the Enya .45 CX cranking some rpm, you can do just about anything you want. The high-speed passes and aerobatics are impressive. Pull the stick back in your lap, and the Tamecat will loop all day long. The more elevator, the tighter the loop, with no surprise stalls. Going at high speeds, most trainers want to climb—not true of the Tamecat. You can fly right on the deck and feel confident that you are in full control. It is very easy to get carried away and feel as if you are flying a sport plane, rather than a great trainer.

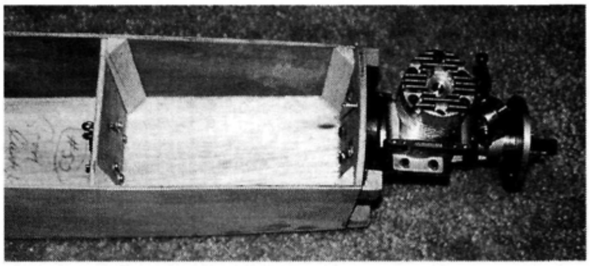
• Aerobatics

It's kind of difficult to discuss the aerobatic capability of a high-wing trainer, but the Tamecat will do just about anything you tell it to. The twin rudders have a wild effect on some of the maneuvers. This plane is just a ball to fly.

• **Wing.** The wing panels are joined with two $^3\!/_8$x6-inch dowels. Test-fit the wing halves and, if necessary, sand or cut the ends of the dowels to a 45-degree angle to get a perfect fit. After you've done this, epoxy the two panels together. Remember to coat both dowels with the epoxy as well. Wipe off the excess epoxy. Use several long strips of masking tape to hold the two panels together. Lay down waxed paper on the workbench and, using stacks of magazines or a sandbag, weight the panel down flat on the bench. The opposite side wing panel should be supported by a $3^1\!/_2$-inch block. Double-check that there is no twist in the wing, and let the epoxy cure for 24 hours.

Install the two aileron torque-rod assemblies in the slots in the torque-rod mounting strips. Notch the wing trailing-edge center, and check the movement again. When you're satisfied with the fit, coat the rods with petroleum jelly to prevent them from being glued to the strips. I marked the locations of the torque rods and glued them in place with gap-filling CA. Then glue the assembly to the wing. After the glue has cured, sand it to conform to the wing. Cover the center section with fiberglass cloth and epoxy. Wrap cellophane around your hand, and squeegee out the excess epoxy. Be sure the cloth is well saturated with the epoxy.

Install the ailerons, and check their movement again. Do not glue the hinges at this time. Sand and trial-fit the wingtips to the wing, and then set them aside.

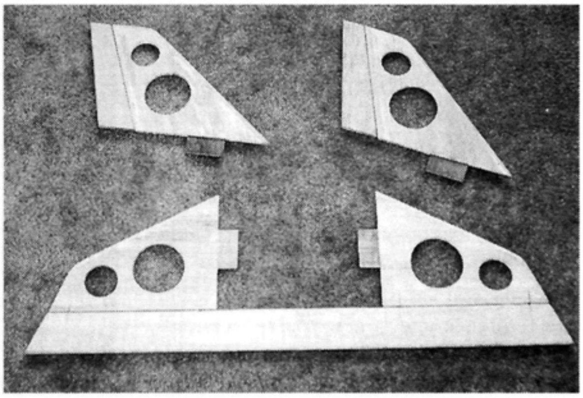


Top view of the engine installation. There is ample room for a fuel tank and battery pack in the forward compartment.

• **Cockpit.** The cockpit is held in place by a rubber band and a steel pin. This makes access to the tank and forward compartment very convenient. The locations of the stops and the bulkhead at the front of the ABS cockpit are indicated in the manual; glue these parts into place. After the glue has cured, tape the cockpit deck onto the forward fuse.

Then drill a $^5\!/_{64}$-inch hole through the firewall and into the ply bulkhead. Remove

the deck, and glue the 1/2-inch steel pin into the firewall with epoxy. For a smooth fit, enlarge the hole in the cockpit bulkhead by 1/16 inch. Then glue the plywood plate to the bottom of the cockpit deck. Drill a 1/16-inch hole in the deck, and screw one eye hook into the plywood. Screw the other eye hook into the nose-gear bulkhead just above the top nose-gear bearing. The deck is held in place by a rubber band between the two eye hooks. This also holds the deck snugly against the firewall—a great idea.



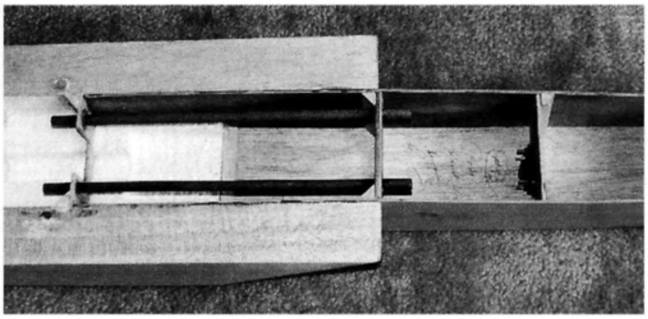
The tail parts for the Tamecat have alignment tabs that fit into slots in the fuse for easy alignment.

FINISHING

Sand the model very carefully, and then vacuum the entire plane and all the plastic parts. Use a tack cloth to remove any remaining dust. I brushed a thin coat of Balsarite* over the entire plane.

I chose 21st Century* mid-blue fabric and lemon yellow fabric and paints. They give a very strong, durable finish.

• **Final assembly.** Apply 30-minute epoxy to the tongues of the stabilizers and to the slots in the fuse. Work the stabs into the fuse, and align the stabs by taping the elevator to them *temporarily*. Remove any excess epoxy. Use the same procedure with the vertical fins. When the stab and fins have cured, install the hinges in the elevator and rudders. Reinstall the landing gear.



The fuselage halves are joined together and then the wing dowels are installed.

ENGINE AND COWL

I chose an Enya* .45 CX for this project. The engine and cowl are simple to install.

First, center the engine mount from side to side, and position the tops of the two mounting rails 1 3/4 inches from the bottom of the fuselage. This will give you a thrust line at the center of the firewall. Secure the mount with 6-32 bolts and blind nuts. Drill the holes for the throttle and fuel lines.

Cut a 2-inch hole in the front of the cowl so the crankshaft can pass through. Trial-fit the cowl to get an estimate of where plastic must be removed. Trim the plastic a little at a time for a correct fit. With the cowl in place, mount the spinner backplate, prop, washer and prop nut. Mark the location of the cowl screws, and drill the 3/32-inch holes through the cowl and hardwood blocks. Remove the cowl, and drill out the holes in the cowl to 1/8 inch. Install the tiller and nose-gear pushrod for the nose-gear steering.

Placing the battery under the fuel tank provided a good center of gravity. Wrap the battery in plastic to protect against fuel leaks. Install the tank and fuel lines, and secure the tank with foam. The rest of the radio installation is fairly standard. The kit includes all the pushrods and clevises needed.

The Tamecat is a real treat for both beginners and veteran modelers. Even inexperienced builders can have fun with this kit. The designer has made it very easy to build and fly. The colors and markings that I used make this trainer look like a hot jet, and the instruction manual is well-written and well-illustrated. So far, my Tamecat has more than 50 flights and has yet to have even a minor problem. So, if you're a newcomer or an old-timer like me, you will definitely enjoy building and flying the Altech Tamecat.

** Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

RPM SPECIAL FEATURE

Hey! Keep the Noise Down!

Reduce dB with available silencers

by C. DAVID GIERKE

I'VE NEVER LIKED mufflers. When I flew competition control-line events in the 1950s and '60s, mufflers were almost unheard of. We considered a loud engine to have power and great performance. Oh, sure; one guy won Precision Aerobatics (open stunt) at the 1965 Nats with a muffled engine; it helped to set him apart from the rest of the pack, but most of us considered it just another gimmick—like wearing a white uniform to impress the Navy judges.

When I switched to R/C pylon racing in the late '60s, nobody used mufflers. The closest thing to a muffler was the tuned pipe, which quieted things a little and enhanced performance a lot. When clubs mandated the use of mufflers to preserve flying sites, like many modelers, I searched for the brand that would reduce engine power the least. Coincidentally, these units were usually the loudest! Some mufflers silenced the exhaust pretty well, but they robbed the engine of power and caused dangerously high cylinder-head temperatures. This resulted in the nasty varnishing of engine components, or worse.

Back then, if you wanted a muffler for your engine, it came from an aftermarket supplier; most manufacturers didn't provide them. More often than not, these units were poorly designed and troublesome to adapt. Exhaust-throttle baffles interfered with muffler clamps and convenient mountings were nonexistent. Mufflers were squeezed to exhaust stacks with modified radiator-hose clamps wrapped around the crankcase. If the crankcase casting was delicate, it easily became distorted (along with the sleeve), and this increased friction and wear with the piston. Believe it or not, one well-known manufacturer still uses this archaic system for some of his engines! Fortunately, by the mid-'70s, most manufacturers had started to equip their engines with mufflers and, unlike old-time modelers, newcomers to gas power accepted them as a way of life.

When Tom Atwood and I initially discussed the format for the "RPM" ("Real Performance Measurement") engine column, my worst fears were realized; he wanted (ugh) *noise evaluation* of every engine that we tested! Like it or not, I had to learn something about sound, noise and mufflers.

FORTUITOUS ENCOUNTER

My first stroke of good fortune concerning sound, noise and mufflers occurred when I met Howard Crispin at the 1992 Nationals. Howard is chairman of the Sound Committee for the Academy of Model Aeronautics (AMA) and his knowledge, along with his optimistic outlook, has changed my attitude toward the problem.

Howard believes that, in the struggle against unacceptably high noise levels, education should be our primary goal. He doesn't believe in the existence of magical technical solutions. Better mufflers, propellers, carburetor-inlet silencing and vibration-absorbing rubber engine mounts help, but alone, they aren't the answer.

Howard provided me with several excellent resources, including a publication printed by the AMA: "Sound and Model Aeronautics—A Handbook for Model Clubs" (a revised and expanded edition is expected soon). After the Nats, I became engrossed in this easy-to-read document, which covered diverse topics such as: basics of sound; noise control and the law; history of noise and model aeronautics—the studies; and, getting quiet—the technology.

To get me started on the right foot, Howard kindly calibrated our Radio Shack sound-level meters on sophisticated AMA equipment.

NEWS FROM NORWAY

My first noise measurements coincided with early engine tests for "RPM." At about the same time, I became aware of

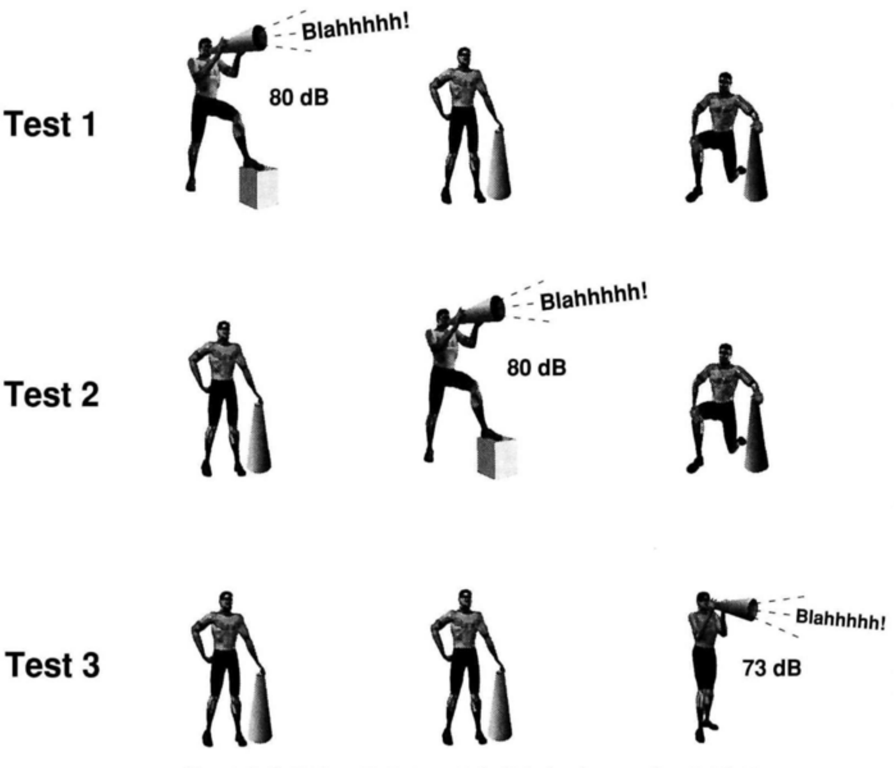


Figure 1. If all three tests are conducted simultaneously, what is the resultant sound level? See Figures 3 through 4.

Tore Paulsen and his noise reduction work in Europe. My introduction to his research arrived unexpectedly from the offices of *Model Airplane News* with a note asking: "What do you think of this stuff?" After a quick read-through, I was enthusiastic, because the excellent discussion of theory was accompanied by practical material concerning muffler design and construction. Unfortunately, many of today's homemade mufflers have little or no connection to theory, while most theoretical dissertations are weak in practical application.

One of the studies provided by Howard Crispin from the old NACA* (National Advisory Committee for Aeronautics) covered the theory and testing of mufflers. This 43-year-old American study used a helicopter as a test bed for more than 80 mufflers of the expansion-chamber and resonator types. Of the many expansion chambers tested, one was superior to all others. The authors stated: "Very interesting results were obtained with muffler no. 19... [it] could prove quite useful in the design of a muffler that is required to attenuate over a wide frequency band." The double expansion chamber with internal connecting tube is the type used by Paulsen.

In their introduction, NACA authors recognized the Germans and others for their design studies, so Tore's reference to the German Helmholz chamber probably reflects these earlier investigations. The technology isn't exactly new; its application to our problems definitely is!

I was anxious to try Tore's adaptation of the double-expansion-chamber design. After studying the construction drawings, I calculated the lengths and diameters of all the components necessary for my Enya .60XF-4G8 test engine. I then asked longtime friend and modeler, Jim Bisson (of Bisson Mufflers*) if he would construct the TP (Tore Paulsen) muffler as a favor. Jim agreed, and within two weeks, a beautifully handcrafted unit was sitting on my workbench ready to be installed and tested.

Tore Paulsen no. 1 muffler (Bisson-made).

Differences between levels in dB	Number of dB to be added to higher level
0	3.0
1	2.6
2	2.1
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4
12	0.3
14	0.2
16	0.1

Figure 2. Combining noise sources.

INITIAL NOISE MEASUREMENTS

• **Tuning the header pipe.** My first procedure with the TP muffler was to tune the ¼-wave header pipe. To do this, I installed a 12x8 APC* propeller, which I intended to use for flying the Airtrax 60 test model. The engine was started, adjusted to maximum speed and the rpm noted. It was stopped and allowed to cool. Using a tube cutter, I shortened the header pipe by ¼ inch and then repeated the above procedure until the tachometer readings indicated that the header was tuned (by the highest rpm obtained). Note: if the pipe is shortened by ¼ inch or so too much, it's OK; the engine will unload (speed up) in flight, making the tuned length correct again. The TP muffler ran almost 1,000rpm faster than the stock Enya muffler, but the measured noise at 9 feet was higher than expected. (More about this later.)

• **Sources of noise.** If you're following Paulsen's discussion concerning the origins of model aircraft noise, you know that an open (un-muffled) exhaust contributes the most noise, followed by the propeller, muffled exhaust and carburetor inlet (in that order). I didn't consider other sources in my testing program because they were probably masked by the highest decibel level; mechanical engine noise is less than

Figure 3. Combined noise levels example.

1 - Difference between levels in dB : 0

2 - Number of dB to be added to higher level : 3 dB

3 - Combined noise level : 80 dB + 3 = 83 dB

Figure 4. Masking of lower noise source.

1 - Difference between the two noise sources : 10 dB

2 - Number of dB to be added to higher level : 0.4 dB

3 - Combined noise level : 80 dB + 0.4 = 80.4 dB

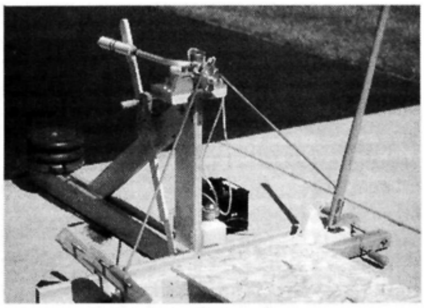
80dB, and the engine is mounted securely on a rigid test stand, thus eliminating the possibility of airframe noise, which doesn't apply here.

Since there's no simple way to determine the level of individual sources of noise (when they're all acting at the same time), they must be measured individually with a minimum of background noise **(Figure 1)**.

• **Explanation of chart.** When separate measurements are made of two sound sources, their combined effect can't be predicted by adding the two decibel readings,

Author intently reads the tachometer while controlling load and rpm—a touchy procedure! Notice that the engine exhaust lingers when there's no propwash to blow it away!

e.g., if two people are both shouting at 80dB, together, they'll measure 83dB, not 160dB (see "Combining Noise Sources" chart—**Figures 2 and 3**). If one source is about 10dB louder than the other, the lesser sound can be disregarded; it is masked by the louder source **(Figure 4)**. Our table can be used for calculating the combined effect of the two sources. If more than two sound levels are involved, combine the highest two first. Then combine this total with the next highest sound level. Continue this until all levels have been added in **(Figure 5)**.



Test setup minus tachometer.

Frank Vassallo takes a dB reading during a test.

MUFFLER-TESTING PROCEDURE

• The test engine is mounted on a solid test stand approximately 2 feet above the concrete test pad and away from any obstructions or sound-reflecting surfaces.
• Noise levels are measured 9 feet away, perpendicular to the engine thrust line, directly opposite the exhaust/muffler.
• Special procedures were required to isolate the propeller and carburetor inlet noise levels. This required two modes of operation:

—Using a propeller as the load.

—Using a flywheel and leather cord as a silent braking device in place of the propeller.

Figure 5. Combining noise levels from three sources.

1 - Difference between the two highest levels in dB : 0

2 - Number of dB to be added to higher level : 3 dB

3 - Combined noise level for the highest two : 83 dB

4 - Difference between combined noise level & lowest : 83 - 73 + 10 dB

5 - Number to be added to higher combination : 0.4 dB

6 - Combined noise level for the three sources : 83 + 0.4 = 83.4 dB

• With the flywheel mode of operation, the engine is cooled by a marine-type cool clamp attached to the cylinder head. Water is supplied by an old battery-operated electric fuel pump, drawing from a 1-gallon reservoir.
• Piping the carburetor inlet to a sound-insulated plenum chamber isolates its noise. The unit consists of a 3-foot piece of ½-inch vinyl tubing that connects the carburetor to a 1-gallon can. The can is sound-insulated with foam rubber, and it breathes through many small holes punched in its base.
• A photocell-type tachometer is mounted on a pedestal in front of the engine; it's operated by the interrupted or reflected light that travels from the propeller or flywheel to its sensor. A ¼-inch-wide painted white stripe runs across the flywheel diameter and acts as the reflecting surface.
• The sound meter is a Radio Shack product.

FINDING THE SOUND LEVELS

It's necessary to find the noise levels of the carburetor inlet and propeller. These quantities will remain constant for all muffler tests; this is ensured by a power-leveling technique in which the throttle is adjusted to a predetermined rpm (12,100) at a standard load (APC 11x8). Because rpm and torque (twisting force) remain the same for each test, the system's power and noise levels (carburetor inlet and propeller) also remain the same. We then measure the total noise level of the system on the test stand (muffled exhaust, carburetor inlet and propeller), and determine the unknown quantity (the muffler) by using the "Combining Noise Sources" chart and the method of iteration (repeated substitutions of numbers).

• **Carburetor inlet.** To determine the inlet noise level, equip the engine with an APC 11x8 propeller, a muffler and the carburetor-inlet silencing unit. Start the engine and adjust the air/fuel mixture to maximum shaft speed; if the engine runs above 12,100rpm, it's acceptable. The relatively light propeller load coupled with a non-restricting muffler design can account for this.

Next, throttle back to 12,100rpm and lock the throttle rod. Record this noise level, e.g., 94dB, for future use, and shut the engine down.

Remove the propeller and install the flywheel. Without changing the throttle setting or the air/fuel mixture, start the engine and "brake" the flywheel to 12,100rpm; record the noise level. This represents the muffler noise, e.g., 90dB. Shut the engine down.

Remove the flywheel and the carburetor-inlet silencing unit. Replace the APC propeller and start the engine; readjust the air/fuel mixture and throttle back to 12,100rpm, then lock the throttle arm and shut the engine down.

Replace the propeller with the flywheel. Start the engine, and "brake" to 12,100rpm. Record the sound level. This represents the muffler and carburetor noise, e.g., 92.5dB.

Calculate the carburetor inlet noise. From the Combining Noise Sources chart, which number, when added to the exhaust noise (90dB), would equal the total noise of the muffler and the carburetor inlet (92.5dB)? Since 92.5dB minus 90dB equals 2.5dB, first check the right-hand column for the number closest to 2.5dB, and project it (2.6dB) to the left-hand column (differences between levels in dB); the difference in levels is 1dB, which means a carburetor inlet noise level of 89dB (90dB - 1dB = 89dB).

If you've followed along to this point, you may be wondering why I bothered to do all this extra work because the muffled exhaust noise was determined during the first flywheel test? Aha! Good question! Whenever a long piece of hose is added to the carburetor inlet, problems occur: flow restrictions and resonant pressure waves usually diminish engine performance. It isn't unusual to experience a 1,000rpm drop with the air tube installed (0.1b.hp reduction for the Enya). There are other problems: it's difficult to "choke" for start-up, and the primary needle-valve response is slow and erratic. By determining the carburetor-inlet noise level, I was able to sidestep the inlet-tube problem altogether. Read on.

• **Propellers.** Our initial tests involving the carburetor-inlet noise level (above) also provided enough data to determine the influence of the propeller.

Example: we know the engine's muffled exhaust measures 90dB. If the muffled exhaust and propeller total 94dB, calculations show that the propeller is producing about 92dB. I determined this by arbitrarily selecting possible decibel levels for the propeller and checking the result against the Combining Noise Sources chart until the noise levels agreed with the total.

Stock Enya muffler.

Example: if 91dB is selected and combined with 90dB (muffled exhaust), the result is 2.6dB, to be added to the higher level (91 + 2.6 = 93.6dB—too low); now try 92dB for the propeller: 90dB combined with 92dB gives 2.1dB, to be added to the higher level (92 + 2.1 = 94.1dB—about right).

• **Mufflers.** Now that we know the carburetor-inlet noise level (89dB) and propeller-noise level (92dB) at a constant power level (12,100rpm), using an APC 11x8 for all tests, the rest is easy, since no carburetor inlet silencing or flywheel is required for any of the other muffler evaluations.

Attach a new muffler to the test engine. Start the engine, advance the throttle to wide open, adjust the air/fuel mixture to maximum rpm, throttle back to 12,100 rpm and record the noise level 9 feet away (95.5dB) with the sound-level meter.

Davis Soundmaster muffler.

Using the data from the example, determine the muffled exhaust noise:

Total noise level—95.5dB
Carburetor inlet noise level—89.0dB
Propeller noise level—92.0dB
Muffled exhaust noise level—??? dB

Arbitrarily choose a potential dB level for the muffled exhaust, and use the Combining Noise Sources chart for the calculations. Let's try 88dB: frst, combine the two highest noise levels: 89dB and 92dB; the difference between them is 3 (column 1); the number of dB to be added to the higher level (column 2) is 1.8; the combination is: 92dB + 1.8dB = 93.8dB. Now combine this number with the next highest noise level (88dB—the muffler); 93.8dB and 88dB; the difference between dB levels (column 1) is 5.8; the number of dB to be added to the higher level (column 2) is 1dB; the new combination is: 93.8 + 1 = 94.8, which is too low and doesn't match the actual total noise level of 95.5dB. Choose a higher level for the muffled exhaust and try again! If you run the calculations for 91dB, you'll have the correct level.

CONCLUSIONS

Mufflers. The modeling public equates objectionable noise levels with inadequate mufflers. The Muffler Test Summary chart **(Figure 6)**, shows differently. The Enya test engine produced 112dB of noise without a muffler (open exhaust). The most effective muffler (Arise) reduced the noise to 89dB—a 23dB reduction. Unfortunately, the decibel (dB) is a non-linear unit of measure; it masks enormous changes in noise *intensity*—a more meaningful linear term. Example: for each 3dB of noise reduction, the intensity is reduced by ½; therefore, the Arise muffler is producing better than *seven halvings:*

- 112dB - 3dB = ½ the original intensity
- 109dB - 3dB = ¼ the original intensity
- 106dB - 3dB = ⅛ the original intensity, etc.

Over the 23dB reduction, the final intensity is less than 1 percent of open exhaust!

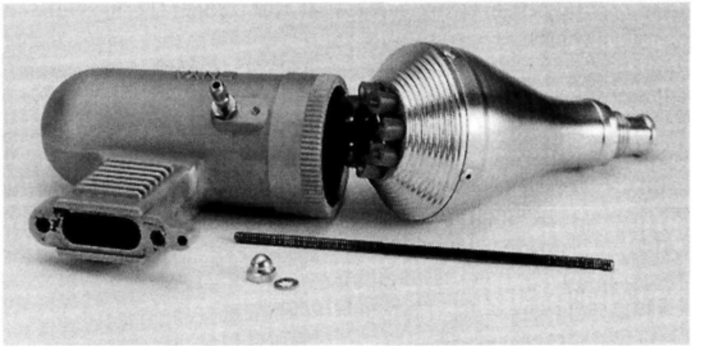
All but one of the contemporary mufflers are good enough to relinquish noise-level leadership to the propeller. In other words, the world's most effective muffler used as part of our "power-leveled" test system would still yield almost 94dB of total noise!

Propellers. Today's high-horsepower 2-stroke engines perform at high rpm levels. Because horsepower is the product of rpm and torque, some argue that it can be raised by increasing torque rather than rpm. Unfortunately, increased torque requires elevated cylinder pressures, and that necessitates sturdier (and heavier) engine construction. A more difficult problem relates to the 2-stroke engine's ability to deliver a dense air/fuel mixture to the cylinder and then retain it for combustion—a prerequisite for high pressures. The cool, fresh mixture is diluted and warmed by leftover exhaust gases, while some of it escapes through the exhaust port. It's all part of the design's relatively poor scavenging (cylinder-clearing) efficiency—a byproduct of overlapping events. It's much easier to reach high

horsepower levels by elevating rpm than by increasing torque. Unfortunately, propeller noise levels increase dramatically as shaft speed increases, quickly surpassing that of the muffled exhaust. If you have any doubt, look at these examples:

• When 4-stroke engines are operated below 10,000rpm, they're very quiet. Some competition fliers have tried to beat the noise problem by keeping rpm down with a high-pitch, low-diameter propeller. By souping up the fuel (25 to 30 percent nitromethane), they have attempted to increase torque and horsepower without the noisy rpm increase. Tradeoffs have their price; this one is high cylinder-head temperatures and lubrication breakdown, neither of which leads to engine longevity.

• I watched (and listened to) a video made by John Piston at the 1994 KRC Electric Fly and was startled by the high noise levels produced by some of the models; in fact, a couple of them sounded just like (gasp!) *gas jobs*. This may come as a shock to electric-power enthusiasts (no pun intended), but if the trend continues toward more powerful electric motors operating at higher rpm, guess what? They'll be just as noisy as gas engines fitted with an effective muffler!



The Du-Bro Arise muffler.

Engines. It has been demonstrated that the 2-stroke engine can be made to run quietly and happily at relatively low speeds (below 10,000rpm). Through proper engine design, cylinder pressures and shaft torque can be maximized by packing the cylinder with a potent mixture of fuel and air. Brake horsepower levels on 2-strokes will always be mediocre compared with those of high-speed engines of similar displacement. Enthusiasts invariably associate performance *only* with horsepower. The "other" factor that's often overlooked is torque; we need to know when it's important. Similar to misconceptions about propeller noise, the roles of engine torque and horsepower are equally unclear; here's where *education* comes to the forefront.

When relatively small, streamlined models are flown at high speeds, high-horsepower engines are required. They spin small propellers at high rpm and are usually associated with racing applications. If you happen to be flying a boxy, high-wing trainer or a WW I biplane, you don't require high rpm or high horsepower; you need a larger propeller turning at a lower speed. This is where torque performance—not maximum horsepower—is needed!

Engines of this type can be designed, but they also produce *lower horsepower*. Should we care? Look at the emphasis placed on horsepower by some manufacturers: "The most powerful .61 in the sport market...horsepower: approximately 2.2 @ 16,000rpm." For most engines, *torque* should be showcased as well as the horsepower produced at that rpm, e.g., 140 ounce-inch; 0.95b.hp @ 8,000rpm.

An engine producing a relatively flat torque curve that peaks between 7,000 and 9,000rpm offers greatly reduced noise levels. With all other factors equal, our test system produced 90.5dB at 11,000rpm, compared with 95.5dB at 12,100rpm. This is considerably less than half the noise intensity level generated at 12,100rpm! Imagine what the reduction would be at 9,000rpm.

Propeller : APC 11 - 8
Leveled power rpm : 12,100

1	2	3	4	5	6*	7**
Muffler	Total noise measured in dB	Inlet noise measured & calculated dB	Propeller noise measured & calculated dB	Muffler noise from dB chart	Muffler noise from dB equation	Muffler noise intensity compared to open exhaust (Calculated from equation) Expressed in % of open exhaust
Open Exhaust	112.0	89.0	92.0	*	111.93	100%
Enya	101.0	89.0	92.0	100.0	100.01	6.6%
T.P. #1	95.5	89.0	92.0	90.0	90.8	0.8%
T.P. #2	95.5	89.0	92.0	90.0	90.8	0.8%
Bisson	95.5	89.0	92.0	90.0	90.8	0.8%
Soundmaster	95.5	89.0	92.0	90.0	90.8	0.8%
Arise	95.2	89.0	92.0	89.0	89.98	0.6%

*6 dB Equation : $dB + 10 \log_{10} I$, where dB = decibels and I = intensity.

**7 intensity from dB equation as above, solving for I.

Figure 6. Muffler test summary.

PUTTING IT ALL TOGETHER

The modeling community has the resources to solve the noise dilemma, but motivating the players to act is the biggest task. Editors of club newsletters can identify and discuss local noise problems. Special-interest-group publications should contain articles that are pertinent to *their* specific noise-related problems. Editors should encourage magazine columnists to devote space to noise-related issues. Within their realm of expertise, authors of "how to" books can also render this important service.

Manufacturers hold an important key to noise education; from their products, to their advertising, to their instruction sheets, they must display leadership and concern for the issues. From a technical perspective, experimenters need to agree on a standardized method of evaluating model aircraft noise; otherwise, we're all speaking a different language. By banding together, the overwhelming majority of sport and competition modelers can make a difference!

Thanks to Frank Vassallo, my partner in aeronautical experiments, for his valuable interpretation of concepts and data. The "RPM" workshop is fortunate to have his expertise continually at its disposal.

**NACA Report 1192, October 1952; Langley Aeronautical Laboratory Theoretical and Experimental Investigation of Mufflers.* ■

GOLDEN AGE OF R/C

HAL deBOLT

GORDON RAE'S RANGER

IN THE PAST, we've discussed early R/C activity abroad. R/C efforts in Germany may have predated American efforts, and the English and Aussies soon saw the fun to be had with R/C; they enjoy OT R/C activity as we do!

Typical early English R/C; Gordon Rae's exquisite single-channel Demon of 1950 was powered by a 1.5cc diesel.

FROM ACROSS THE POND

This time, we have an interesting report from an English R/C pioneer, Gordon Rae, who follows this column with pleasure. I've reported on Gordon's exquisite Demon plane design, and now Gordon tells me that it was only an interim design while he was developing a more sophisticated system and aircraft—his 1951 "Ranger project."

Gordon's objective was to have a "pulse-proportional" system to provide rudder and elevator control plus fast or slow engine speed—quite ambitious for a time when we all were happy just to have successful rudder! He used a transmitter that sent bursts of the radio frequency. A magnetic actuator deciphered this pulse rate and operated the rudder. An increased pulse rate operated the rudder while an amplifier detected the increase in rate; then the amp output actuated an escapement for elevator control. The escapement had two neutrals, one of which actuated a second escapement to give high and low engine speed.

At that time, the only popular and proven means of control were the escapement and pulse methods, both of which Gordon used. The unusual capability to detect both high and low pulse rates provided the way to additional controls.

Why not a magnetic actuator for elevator also, you ask? He wanted simultaneous controls, which would have increased the system's complexity. Gordon tells us that he developed this system while he was gaining flight experience with simple "rudder only" in his Demon model. Eventually the bugs were worked out, and he thought that the multi-system was reliable enough for flight.

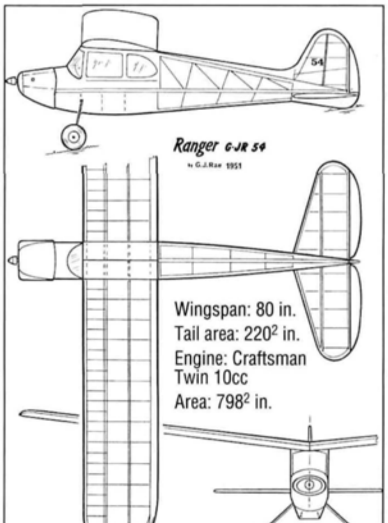
Gordon Rae's 1951 twin-cylinder-powered "Ranger" used Gordon's own "pulse" plus escapement system for multi-controls. The Ranger still exists!

You know, if you aren't searching for elusive multi-controls, such a complex system might seem stupid. But there was nothing stupid about the exhilaration that you felt when a loop followed that first elevator command! In 1951, you got it the best way you could!

Gordon tells us that the system worked but, as you might suspect, remembering the command sequence proved a real challenge.

Gordon needed to design and build his model *plus* build the engine to power it—a good indication of how extensive early R/C projects were. (Remember, this was England, not the USA.) The photo and 3-view show a pretty, aerodynamic, fine R/C model. Gordon says the design was influenced by McElwee's "Robot"; again, note the modern appearance.

Have you noticed any references to "casting kits" in craft magazines? Gordon enlisted his father's aid to build a .35-size engine. When this proved weak in the power department, they turned to model cars for a larger twin cylinder, also made out of castings. This engine did have enough power.



Three-view of Englishman Gordon Rae's modern-looking 1951 "Ranger" R/C model—his 54th design!

Gordon still has his original Ranger," which could fly again, plus a replica of his Demon. OT R/C is surely alive in merry old England!

It might be difficult to imagine the effort that scratch-building an engine demands, but I have a vivid recollection of what it takes. In CL speed days, I successfully used Ralph Steele's R.B. Specials. Ralph insisted that "lapped pistons" were best, but McCoy introduced "ringed pistons," which showed considerable merit. I was impressed. I prevailed on Ralph for the R.B. sand-castings and spent the large part of one winter producing a "ringed" R.B. from scratch—took quite a time! (It's very difficult for the uninitiated to comprehend such a task!)

Here's another story on scratch-building engines. Frank Schmidt was an excellent craftsman and engineer who pioneered commercial R/C reed systems. He produced every bit and piece in-house—except for electronic components, of course. Frank told us that he produced his first R/C model in 1923. Like Gordon Rae, he had to design and construct the whole ball of wax, including the engine! Would you believe that, 30 years later, he still had the model intact?

When Frank learned he had a terminal illness, he quickly "retired" saying he wished to fulfill a lifelong ambition sparked by that first engine—machinist work. His first efforts were a couple of "gas" engines, made out of castings, of course. Success with these led him into "steam" engines. Over a two-year period, he produced a score of them, each with unique features. The culmination of his dream was a giant-scale, operational steam-driven McCormick-Deering farm tractor. In a demonstration, one of my youngsters rode on it while Frank drove it about. His final ambition was to "R/C" the tractor with one of his reed systems.

Unfortunately, time ran out for this fine gentleman/modeler before that dream could be realized. Frank left us when he was in his prime. The question will always be: how far could his marvelous intellect have carried R/C had he lived on?

NEW PRODUCT

On another note, in citizens-band times, R/C was plagued by interference; our

KRAFT'S "KWIK FLIS"

Through the years, we've seen many R/C'ers dominate the scene. First the Good brothers, then Alex Schnieder, Jim Walker, Bob Dunham, Ed Kasmirski and on and on. Invariably, they brought excellent craft to the table and advanced the sport. One of the outstanding times was the Phil Kraft era.

In the early R/C days, Phil Kraft joined Dunham, McNabb, Hoover, etc., with his rudimentary, single-channel systems. Like the others, Phil saw a future in the R/C equipment business. Apparently, Kraft spent his early time developing equipment and establishing a sound business. By the early '60s, Kraft Industries was a viable operation that supplied a major portion of the R/C market. It seems that, with success, Phil decided to enjoy the sport—a decision that resulted in a very successful competition career.

The '65 Nats winners (left to right): Cliff Wierick and "Candy" took second place; Phil Kraft with his Kwik Fli took first place; plus Jerry Nelson with his Roman.

Phil Kraft won the first Tournament of Champions hosted by Maurice Woods at Oklahoma City. Left to right: Cliff Wierick, Maurice Woods, Phil and Doug Spreng. Kraft's Kwik Fli is on the left.

Phil Kraft produced a variety of aircraft designs—all fundamentally sound, basic concepts. Never one for frills, the outstanding performance of Kraft's planes belied their simplicity. It was not long before Phil's domination of the contest trail led to his national and world championship titles.

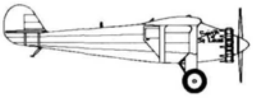
He named the design that led him upwards the "Kwik Fli" and soon developed it into a series. The Kwik Flis easily blended into flight lines with their run-of-the-mill appearance, but like any fine performing craft, they had what was needed, plus little more.

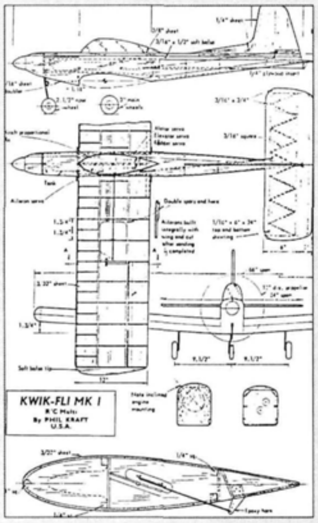
Their only outstanding feature was a 20-percent-thick airfoil—apparently, following the Kazmirski theme. Structurally, they were simple sheet-balsa combos that were quick to build and easy to fly. The low-wing sportsters of today reflect that the Kwik Flis were a foretaste of things to come.

Phil's contest flights spoke volumes about the Kwik Fli's capabilities. Especially with

Kraft with one of the last Kwik Flis. Note the attention given to streamlining and the switch to "strip ailerons" with this version.

authorized frequencies often became intertwined with the CB operators'. One safeguard was to check the frequency with a "monitor" before flying, so unlike now, monitors were common. Recently, a monitor that's much more sophisticated than the early breeds has become available. Obviously, if you suspect interference, it could be a great help. This one is offered by CommSpectrum, 2263 NW 2nd Ave., Ste. 20Z, Boca Raton, FL 33431. My "quick check" indicated that it does perform as its manufacturer claims. ■

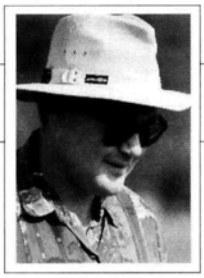




Three-view of Kraft Kwik Fli Mk I.

the early versions, it was obvious that maneuvers required very little correction. The winning planes at Phil Kraft's Championships indicated that frills do not buy 10-point scores, but honest performances do. An OT'er could do worse than to consider one of the Kwik Flis. Simplicity plus performance; is that your cup of tea?

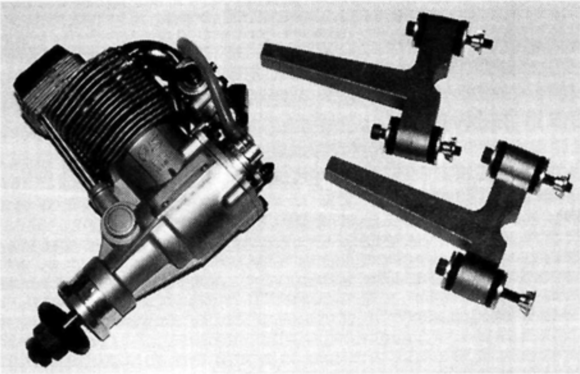
SCRATCH-BUILDERS' CORNER



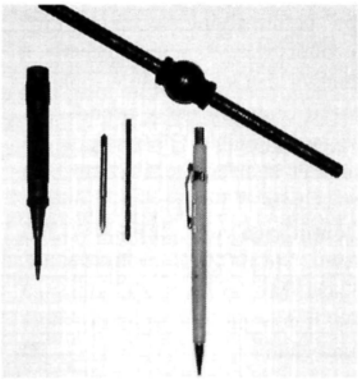
GERRY YARRISH

HOW TO DRILL AND TAP ALUMINUM ENGINE MOUNTS

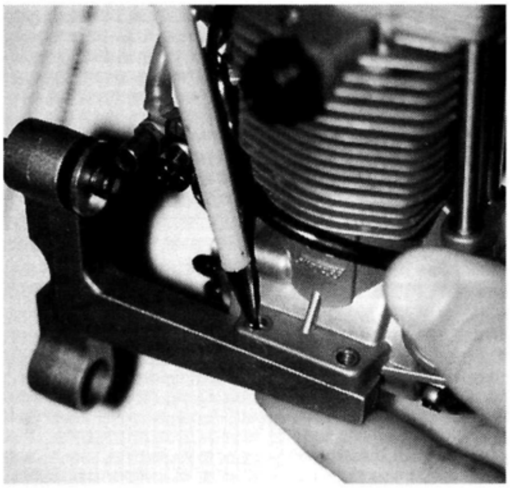
Aluminum engine mounts are a great invention; they're strong and light, and the new Du-Bro* vibration-reducing motor mounts help to reduce aircraft harmonics and airframe-induced noise. Many of the plans in our "Plans Mart" use this type of engine mount. Here's the quick and easy way to drill and tap aluminum engine mounts.



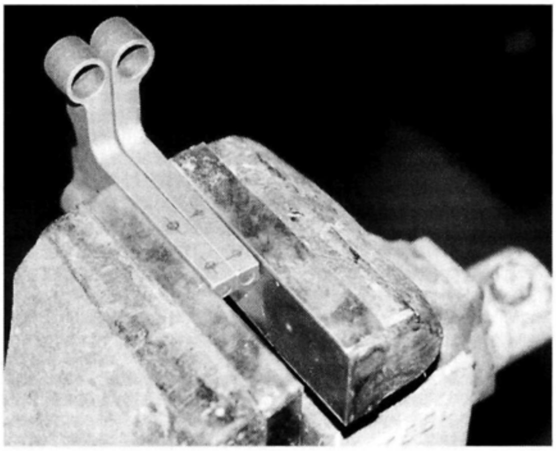
1 First, decide which engine mount is best to use with your engine. Most engine mounts come in many sizes and lengths. Use your plan's side view to determine the distance between the firewall and the prop-drive washer. Buy the proper mount for the job.



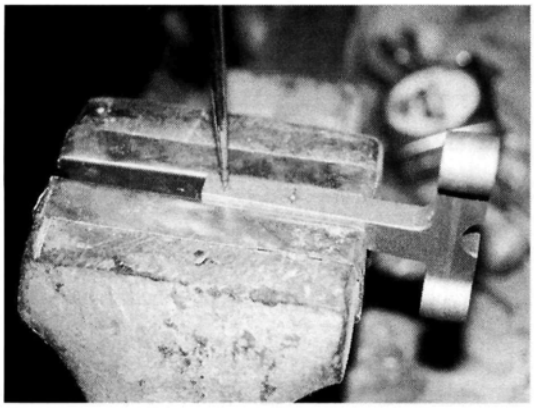
2 The tools you need: a center punch (here, I have a spring-loaded automatic punch that doesn't require a hammer); a tap and drill bit of the proper size and tap holder; a small square (not pictured); and a scribe, awl, or pencil to mark the hole locations.



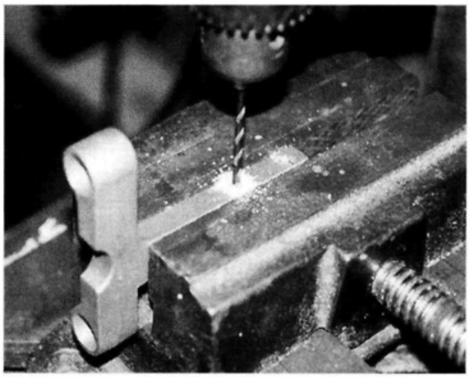
3 Place the engine (here, an O.S.* 1.20) on one of the engine-mount beams, and mark the engine-mount holes' position. Use a very thin pencil or scribe to accurately transfer the mounting-hole positions to the beam.



4 Clamp both engine-mount beams in a vise with their front edges aligned, and mark the holes' centers on the second beam. A small square or straightedge is best for this.

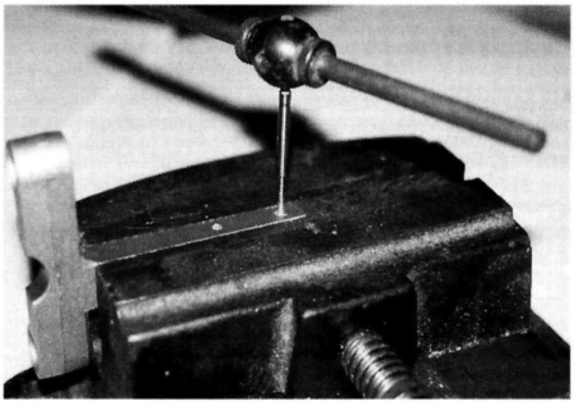


5 Center-punch the hole locations. Take your time, and make sure you have precisely placed the punch before you strike it home.

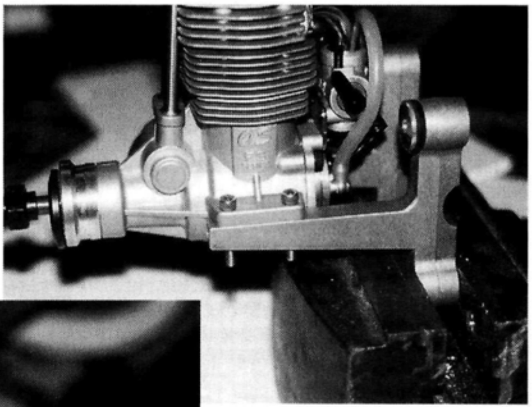


6 As you drill the holes, be sure to keep the bit square with the top surface of the beam. For an 8-32 tap, use a no. 29 (0.136-inch) bit. Drill at a low speed—about 500rpm. Back the drill out frequently to unload the bit of metal chips and to minimize heat.

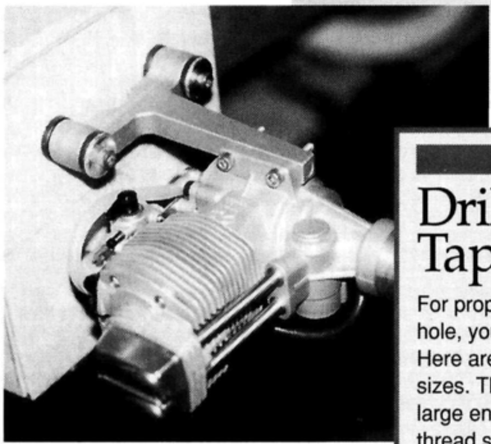
PHOTOS BY GERRY YARRISH



7 ***Next, clamp each of the beams in a bench vise, and tap the holes. Keep the tap perpendicular to the top surface of the beam and, with firm pressure, insert the tap with a half twist. Once the tap starts to grab, keep it straight and advance it one half turn at a time. Before you advance the tap again, back it out ¼ turn to break the metal burr that forms in the hole. If you like, you can use kerosene as a cutting fluid, but aluminum can be tapped dry while using small-size taps.***



8 ***Clean the holes of burrs and metal chips, and mount the engine with 8-32 cap-head screws. These should fit the holes perfectly, but if they don't, you can ream the holes slightly for a proper fit.***



9 ***With the engine-mount beams firmly attached to the engine, it is much easier to mark where the holes for the mount will be drilled in the firewall. Use vertical and horizontal center lines to obtain the thrust center line and the positions of the four mounting bolts. Drill the holes, install the blind nuts, and bolt your engine into place.***

Drill Bit and Tap Size Chart

For properly formed threads in a tapped hole, you need to start with a drill bit. Here are some common bit and tap sizes. The sizes given produce a hole large enough to produce a 75-percent thread size. This is more than strong enough for model aircraft use, and it minimizes the force required to cut the threads.

Tap size	Drill bit no.	Drill decimal size
2-56	50	0.070
4-40	43	0.089
6-32	36	0.107
8-32	29	0.136
10-24	25	0.150
10-32	21	0.159
¼-20	7	0.201

(Scratch-Builders' Corner continued on next page)

SECURING THREADED JOINTS

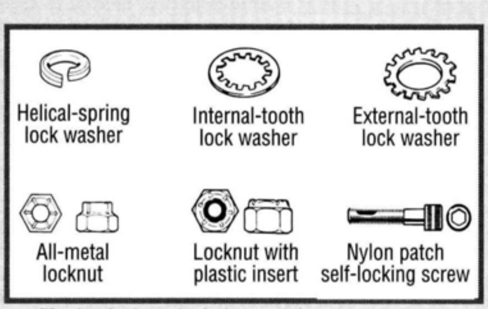
A threaded joint that comes unfastened because of vibration or other environmental influences can cost you your plane or helicopter. I'm sure you have seen mufflers fall off engines in flight, props fly off the drive shaft and engines come loose from their mounts. Such things happen because a threaded nut on a screw or a screw in a tapped hole tends to turn when subjected to vibration or impact. This is a common but largely unaddressed problem. If you want to secure your model's threaded joints effectively, here's what you need to know.

MECHANICAL LOCKING METHODS

Tightening the joint puts tension on the screw to increase the torque required to move the nut. A lock washer helps keep the joint tight by increasing friction between the nut and the surface against which it bears. Lock washers are cheap but, if the nut turns enough to lessen the tension on the screw, the joint can be subject to failure. Multi-tooth washers are generally better than simple, helical spring-lock washers.

A second—excellent—solution is to use a locknut with a plastic insert that is deformed during installation. These resist being turned under vibration, even if the screw is not under tension, so they're the best choice when frequent disassembly is required (they should be replaced after a few disassemblies).

Screws with a plastic patch over part of their threads provide some of the vibration-resistance benefit of a plastic-insert locknut (at a lower price), but they must be replaced more often and aren't easy to find in retail stores.



Mechanical methods for securing threaded joints

ADHESIVE LOCKING METHODS

Adhesives provide an alternative, and often better, solution. Here's why: "breakaway torque" is the torque required to start turning a nut; "prevailing torque" (normally less than breakaway) is the torque required to continue turning a nut. Resistance to prevailing torque is one of the big advantages that adhesives have over lock washers.

Pacer Z-42 Thread Locker and Loctite 242 Threadlocker. Thread-lock comes in a variety of strengths and viscosities for specific applications.

Most of us have used paint, epoxy, CA, or some other type of adhesive to secure a nut. These work fairly well under some conditions, but they don't provide a "controlled breakaway," or reliably inhibit prevailing torque, and they can shrink and be affected by fuel.

Controlled thread-locking performance for metal-to-metal and some non-metal-to-metal joints is provided by a class of adhesive that, like CA, cures anaerobically (in the absence of air). Anaerobic adhesive is frequently referred to as Loctite®—the common name for the Threadlocker® line of anaerobic adhesives developed and produced by the Loctite Corp.* Similar materials are marketed by Loctite Corp. to the automotive industry under the name Worldtech®* and by Permatex® Industrial, a subsidiary of Loctite Corp. Pacer Technology*, the maker of the Zap line of adhesives for modelers, sells an anaerobic adhesive named Z-42® for locking metal-to-metal joints. For plastic-to-plastic joints, they market Zaplock®, a cyanoacrylate (CA) product.

Thread-lock is most useful for locking metal, threaded joints. It's also useful for some metal-to-plastic and plastic-to-plastic applications (it dissolves some thermoplastics).

If you want to use just one grade of thread-lock for all applications, I recommend Loctite no. 242, or a functional equivalent such as Pacer's Z-42. (Use of an activator sold by the same thread-lock manufacturer helps ensure a better bond. Do not use CA accelerator.)

THREAD-LOCK ADVANTAGES

- Locking occurs in the joint and does not add to the bulk of the joint.
- If breakaway takes place, there will still be resistance to prevailing torque.
- Thread-lock cures without cracking or shrinking.
- Thread-lock will not cure outside the joint, and excess can be removed with alcohol or mineral spirits.

THREAD-LOCK DISADVANTAGES

- Thread-lock is not ideal for joints that have to be disassembled frequently.
- The thread-lock grade discussed in this article is not suitable for use at temperatures above 300 degrees Fahrenheit.

WHAT YOU NEED TO KNOW

- Use locknuts with plastic inserts or an anaerobic adhesive to lock threaded joints that are subjected to a high vibration or shock environment.
- For metal-to-metal joints that must be frequently disassembled, use plastic-insert locknuts.
- A 10ml bottle of thread-lock should do for most modelers and is likely to be used up within the product's shelf life—typically, one year.
- The grade you use is less important than the guarantee that it will cure; up to 24 hours is required for the joint to develop its full breakaway strength.
- An activator is required to cure a joint in the presence of some surfaces. If thread-lock is used in a critical application, especially if plated nuts/screws are involved, or if they are stainless steel or non-ferrous, use an activator.
- The safest, most conservative approach is to use thread-lock and activator on clean parts. If it's a critical application, test a joint after allowing the material to cure for at least 24 hours.

Where do you get anaerobic adhesives? You're most likely to find them at a hobby dealer, an auto-parts store, or an industrial supply house. Use them, and you'll better ensure the longevity of your favorite models. Happy flying!

—*Robert S. Hoff*

****Addresses are listed alphabetically in the Index of Manufacturers on page 146.*** ■

SCALE TECHNIQUES

GEORGE LEU

PERFECTING PANEL LINES

I'D LIKE TO mention one of my favorite phrases, "high visual impact." It refers to the "wow" factor that a model has when it's on the flight line with other aircraft. No matter how well-finished the other models are, the model with "high visual impact" commands attention. This month's column will give you the opportunity to own such an aircraft.

Bob Boswell's Frankel-designed F4D Skyray has excellent panel line details, which add high visual impact to his model. Bob uses the chart tape method here. What a beautiful jet!

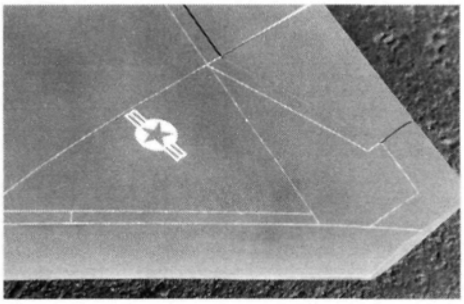
In the October issue of *Model Airplane News*, I suggested that you make panels by cutting shapes out of MonoKote trim sheets and applying them to your sport planes. I also suggested that butyrate sheets could be cut to shape and used as "raised" panels on your plane. I hope you've had a chance to try these ideas, because here come some more!

WHAT ARE OUR GOALS?

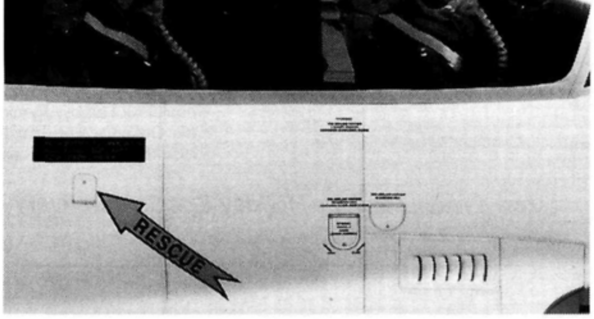
As a general rule, civilian aircraft don't have as many panel lines as military aircraft. If you want a high static score, you must accurately replicate the panel lines on your model. So to be successful in scale competition, modelers should:

- Make models resemble full-size aircraft.
- Improve outline and craftsmanship scores.
- Give models a high visual impact (panel lines do this).
- Improve building and flying skill levels.

Remember that a finely detailed scale model is only as good as the surface underneath its detailing. Panel lines and rivet details will not hide a poorly finished surface. The model's surface should be primed and finish-sanded with at least a 360-grit sandpaper before surface detail is added.



Here's the wing of my George Miller-designed YF-22 jet. Prior to painting, I applied the panel-line tape over a gray base color. When the tape is removed, the effect is very pleasing and adds a lot to any model.



Dave and Tony Malchione placed second in Team Scale at the 1995 Top Gun Invitational with their BVM T-33. The panel lines on the T-33 are molded into the fiberglass fuselage at the factory.

START WITH A GOOD BASE

I prepare my surfaces by first spraying them with aluminum-colored paint. This gives a consistent finish to the airframe and highlights any surface imperfections. I use aluminum because most aircraft are built and skinned with aluminum, and it is easy to draw on. (When I discuss "weathering" in a future column, the aluminum base coat will play an integral role.)

I've used Cheveron* Perfect Paints aluminum and Testor's* Model Master aluminum paint with good results. The secret to applying any aluminum-colored paint is to spray on several light coats. If the paint runs, let it dry, wet-sand the area, and spray it again.

DRAW IT OUT

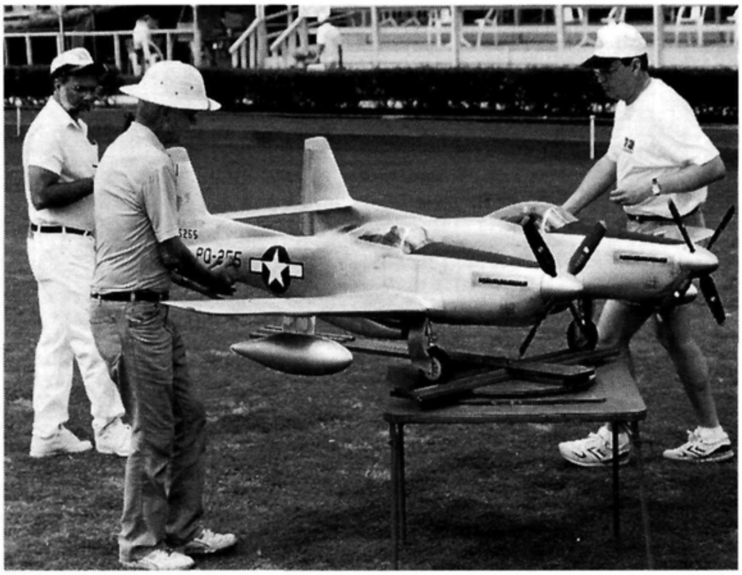
When the paint has dried, I use a sharp no. 2 pencil and an 18-inch flexible metal ruler with a cork backing to draw the panel lines on the fuselage, wing, etc., according to my 3-views.

I usually mark a few panel lines on the port side and then on the starboard side. I often work on the wing panels first and then the stab sections, because it's easier to work with large surfaces. I can then tackle the work around the fuselage. I usually allot 2 hours for the work and stop when the time is up. This keeps me fresh and motivates me for the next basement session.

In the '70s and '80s, I didn't draw

all the panels on my models, and yet I had a good deal of competition success. Some of my planes had no panel lines at all. Today's competition standards are much higher, and panel lines should be drawn to reflect 100 percent fidelity to scale.

When I've finished drawing panel lines, I use a 1-inch camel's hair brush to clean off any dust. If I've drawn a line in the wrong place, I erase it, brush away the dust and redraw it. Pencil dust is messy and smudges very easily, so clean up between jobs.



At 1995's Top Gun Invitational, Ret. Col. Art Johnson competed with his aluminum-clad twin Mustang. This beauty had character and very high visual impact. Panel lines, hatches and rivet detail are Art's trademarks.

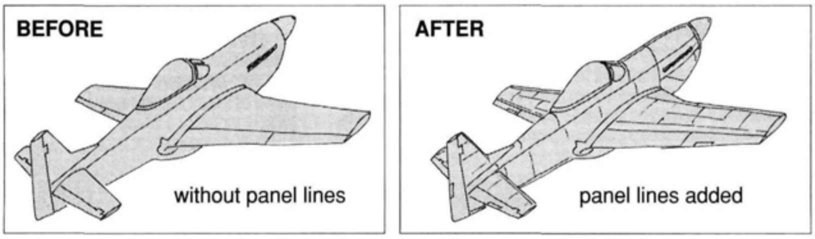
PANEL-LINE TAPE

Next, depending on the scale of my aircraft, I lay 1⁄64- or 1⁄32-inch chart tape (available from office supply stores and commercial art supply stores) along the panel lines that I've drawn. Whether you butt the edges together or overlap your joints is not important. What is important is for you to follow your pencil lines with this tape.

When I've finished, I wipe down the aircraft with a good "prepping agent" such as R-M Paint 900 Pre-Kleano or DuPont PrepSo 13919S. Do this in a well-ventilated area (preferably outside), and apply these products sparingly. You don't want to move the tape but, if it does, wait until the cleaning agent evaporates and reposition it.

Panel lines are not always spaced evenly. If the tape lifts up from the surface in one or two areas, it will not bother the effect we are trying to achieve.

The next step is to spray paint your model. I usually apply two coats and wet-sand with 320-grit paper after the first coat. The paint seals the tape onto the plane, and it won't come off during wet-sanding. After the second coat has dried, I remove the tape from the aircraft.



These illustrations of a P-51D show how just a few panel lines add to the model's appearance.

PEELING PANELS

Removing the tape is not as easy as it may seem. You'll probably need an X-Acto knife and tweezers to remove all of it. I've found that 1⁄32-inch tape holds together much better than 1⁄64-inch tape. The thinner tape makes very fine panel lines for 1⁄9-scale through 1⁄7-scale models. The 1⁄32-inch tape forms panel lines that are slightly too wide for these small scale aircraft. It's a subjective call, and only you can make the decision after trying the procedure.

When I've removed all the tape, I again wet-sand the airframe. Using 400-grit paper (don't use a sanding block), sand the sharp edges off the panel lines, but don't sand the edges so much that you remove the panel lines!

When the plane has been finish-sanded, you have a number of options. You can let the panel lines reveal the aluminum base coat, or you can paint the entire structure and still let the three-dimensional panel lines show. After painting, some modelers use an awl to scratch the paint out of the panel lines and show a little of the aluminum base coat. Others use a silver lead pencil and draw in the lines to highlight them. The choice is yours; you may even find your own, new technique, or combine some of these ideas.

I'll have other panel and panel-line ideas for you in my next column. In the meantime, please send in some photographs of your scale subjects for the column. I'd like to show off our readers' scale projects for others to see and enjoy. Include some information about you and your airplane and, if you have a scale technique to share, I'll try to pass it along. See ya!

** Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

SR Wins '95 AMA Electric Nats!

Well, we didn't exactly win the Nats. We won half of the Nats, or at least our customers did!

Class A Sailplane (610), Class B Sailplane (612), Class A Old Timer (618), and Class B Old Timer (620) were flown. In each event there were three winners, First, Second, and Third for a total of 12 possible winners. SR Max Series packs were used to win 6 of the 12 winning positions. And in addition, the SR Smart Charger/Cycler was the charger used to win those 6 winning spots.

Tom Hunt won First Place in Class A Sailplane, Second Place in Class B Sailplane, and Second Place in Class B Old Timer using SR 1100 Max Series packs and the SR Smart Charger/Cycler. Tom was flying his new Defiant high aspect ratio design in the Sailplane Events and his Kerswap in the Old Timer Events.

Don Belfort won Second in Class A Old Timer with his Viking and our SR 1100 Max Series cells. Don is known for flying unusual aircraft.

Bob Aberle won Third in both Class A and B Old Timer with his beautiful Lanzo Bomber. This is the same aircraft Bob has been using so successfully in "SAM" competition with our SR SAM 800 Series cells. The SAM rules limit you to a maximum capacity of 800mah so Bob uses SR SAM 800 packs rather than the SR 1100 Max packs in SAM competition. Bob very kindly credits our Smart Charger/Cycler with a lot of his success. We think his skill had at least something to do with it!

SR's Steve Anthony launches Tom Hunt's Kerswap to a Second Place win in Class B Old Timer at the '95 AMA Electric Nats in Muncie, Indiana.

A new cell, the SR Max 1200 LMR Series, was introduced at the Nats and should be a sure winner next year. It has more capacity and a lower internal impedance but only weighs 1/10th ounce more than the 1100 Max Series cell that was so successful this year. It is designed specifically for Limited Motor Run (LMR) events and very high current drains.

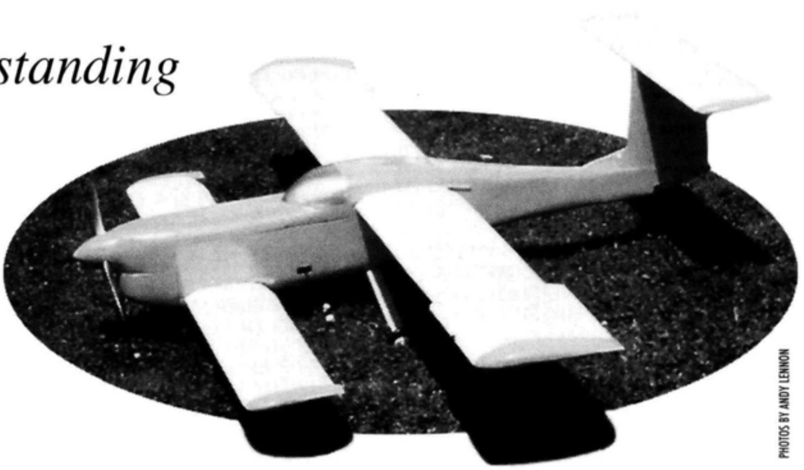
Another new cell for the Electric Flyer is the SR 1800 Max Series cell. The 1800 Max is a SubC size cell and is identical to our 1500 Max cell in size. Weight wise, it's only a hair heavier but it packs a lot more flying time. If you're looking for long flight times at high current draws, the new SR 1800 Max pack is the pack for you!

SR salutes everyone who participated in this year's AMA Electric Nats and the National Electric Aircraft Council (NEAC) who ran the event. We invite all of you to attend next year's AMA Electric Nats to be held in Muncie the last weekend in July '96.

If you'd like more information about the Electric Nats or any of our packs, chargers, motors, or other Electric Flight supplies, call 516-286-0079 or write us at SR Batteries, Box 287, Bellport, New York 11713. And please don't forget, when it comes to receiver and transmitter packs, SR is the best. As we've always said, "The best radio gear, is no better than its batteries!"

HOW TO

Further understanding forward-wing designs



PHOTOS BY ANDY LENNON

by ANDY LENNON

Part 2

Canards, Tandem Wings and Three-Surface Design

A LOGICAL, methodical approach to designing any model aircraft is beneficial—particularly so for canards, tandem wings and three-surface types. The following steps will be detailed in this article:
• Power and control unit selection.
• Overall weight estimation.
• Wing loading selection.
• Level flight speed estimation.
• Neutral point (NP) and center of gravity (CG) positioning.
• Sizing of fore and aft wings.
• Aspect ratio and planform selection.
• Longitudinal and vertical separation.
• Airfoil selection.
• Angles of attack of wings.

LOGICAL DESIGN STEPS

• **Power and control unit selection.** As discussed in "Wing Design, Part 1" (*Model Airplane News*, January 1993), the power and control units together weigh 50 percent or more of most models' total weight. The first step in design is to choose these units and obtain their weights.

• **Overall weight estimation.** Obtaining a rough preliminary weight estimate while the model is still in the conceptual stage is essential but not easy. The data on weight estimating in "Stressed Skin Design, Part 2" (October 1992) will help. When the model's size and proportions have been established, a more accurate weight appraisal is advisable. "Wing Design, Part 1" also provides insight into obtaining this estimate.

• **Wing loading selection.** The type of performance desired governs the choice of wing loadings. "Wing Design, Part 3" (March 1993) suggests wing loadings in ounces per square foot of wing area.

If the design is to incorporate flaps, then higher wing loadings are in order. When deployed, their additional lift and drag will provide reasonable landing speeds. With weight and wing loading established, the wing's total surface area is easily calculated.

$$\frac{\text{weight (oz.) x 144}}{\text{wing loading (oz./sq. ft.)}} = \text{wing area (sq. in.)}$$

• **Level flight speed estimate.** This is essential in determining the angles of attack of the fore and aft wings (to be discussed in Part 3). The following articles will provide a basis for this estimate:
• "Wing Loading Design" (August 1992).
• "Propeller Selection, Part 1" (November 1992).

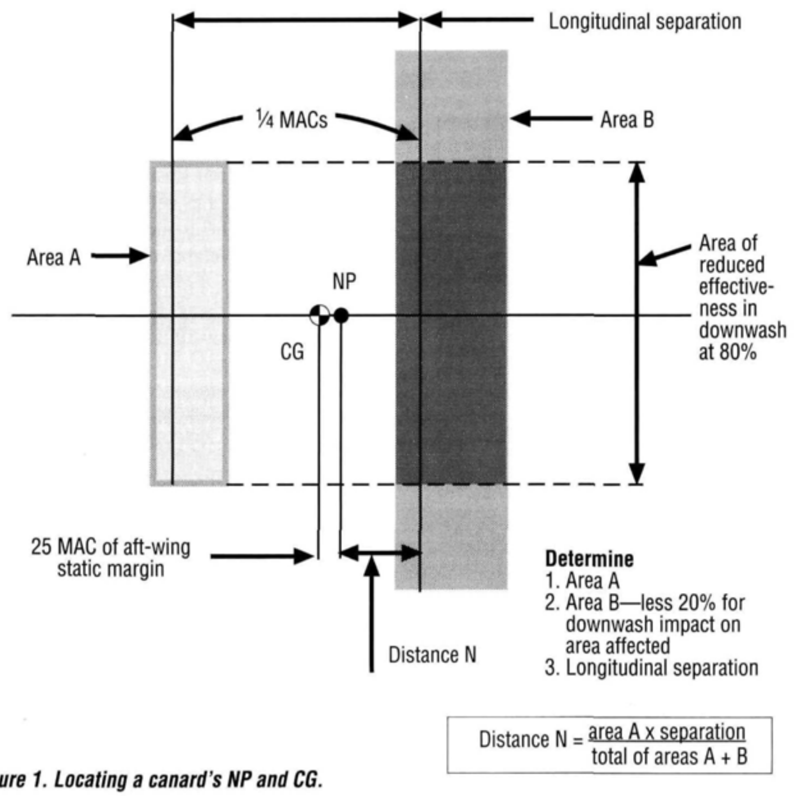


Figure 1. Locating a canard's NP and CG.

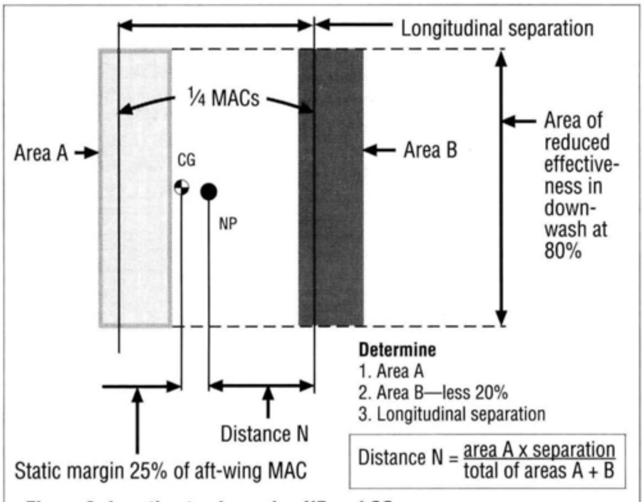


Figure 2. Locating tandem-wing NP and CG.

• "Estimating Level Flight Speeds" (February 1994).

• The neutral point and center of gravity location. The NP concept was discussed in the article, "CG Location" (April 1993). For the three types of forward-wing models, both CG and NP will fall somewhere between the two lifting surfaces. Precisely calculating their locations is very complex and beyond the scope of this article. In full scale, the calculations are confirmed by wind-tunnel tests or actual flight tests with the CG at various locations.

A simplified method is proposed; it considers areas and their separation and effectiveness. Figure 1 covers NP and CG locations for canards, Figure 2 for tandem-wing designs and Figure 3 for three-surface models. The normal static margin for stability is 10 percent of the main wing's mean aerodynamic chord (MAC). Use of a 25-percent static margin as suggested leaves a 15 percent margin of error. Test-flying the model with cautious rearward CG movement will confirm your calculations.

• Sizing of fore and aft wings. The total wing area, having been established, must be divided between the two lifting surfaces.

Canards. From the discussion of NP and CG locations, it is apparent that the smaller the foreplane, the farther back NP and CG will be and vice versa. The area relationship between the two lifting surfaces locates NP and CG.

The heaviest component is the power unit. Its location dictates the area relationship of fore and aft wings. A pusher-engine design would require an aft CG, a small canard and a large wing. A front-engine design would reverse this situation.

If flaps are used, they must provide balanced lift when extended. Too much additional lift from either fore or aft wings would result in very serious pitch problems—either a dive or a stall. Obviously, both sets of flaps must be extended simultaneously for balance.

With a small canard of 15 percent of the aft wing in area, flaps on the aft wing would be much more powerful than those on the foreplane. Another disadvantage of a small canard and rearward CG is the reduction in moment arm to the MAC of the vertical tail surface(s); it necessitates very large vertical areas. Burt Rutan solved this problem by using aft-wing sweepback and placing the vertical surfaces at the wingtips (Figure 4). This substantially increases the moment arm. The Canada Goose (Figure 6, Part 1) design, with a modest 5 degrees of aft-wing sweepback, had the same philosophy applied to it.

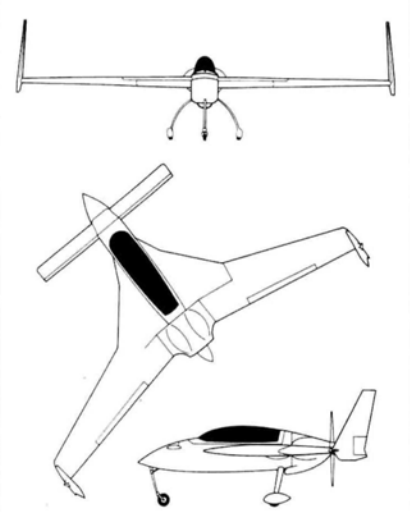


Figure 4. Three-view drawing of the Rutan Long-EZ.

Sweepback reduces lift. As airplane designer John Roncz put it, "You get around 14 percent more lift per degree of angle of attack at zero sweep than at 30 degrees of sweep."

The Swan (Figure 15, Part 1) had a straight aft wing, but its vertical surfaces projected behind the wing. Twelve ounces of ballast were needed to correctly position its CG—as had been anticipated after doing the "Balancing Act" (May 1993) for this model. The minimum canard area is 15 percent of that of the aft wing. For a front-engine aircraft, such as the ill-fated "Pugmobile," a foreplane area of close to 60 percent was used.

The Canada Goose had 31 percent foreplane; the Swan had 37 percent. Using a foreplane of 30 percent as an example, total wing area would be 130 percent.

For a total wing area of 600 square inches, foreplane area would be

$$\frac{30 \times 600}{130}$$

or 138.5 square inches and aft wing

$$\frac{100 \times 600}{130}$$

or 461.5 square inches in area.

The designer needs to take the area relationship into consideration.

(Continued on page 112)

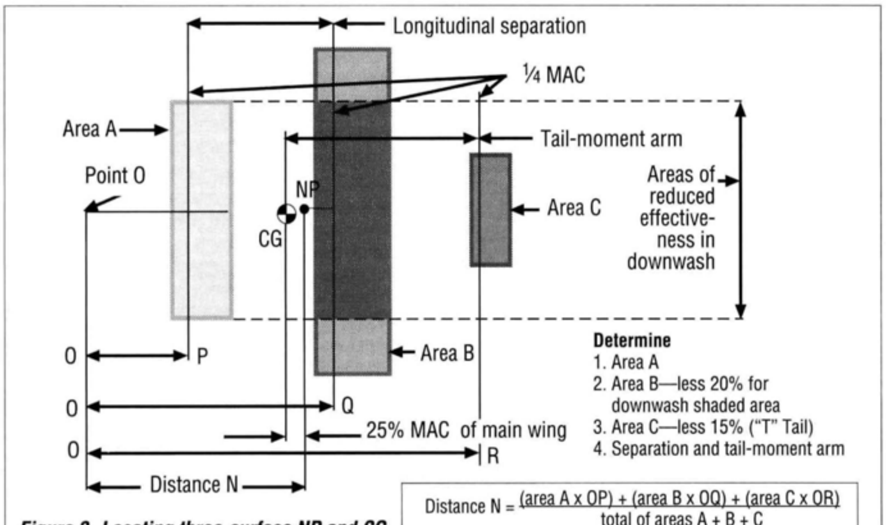


Figure 3. Locating three-surface NP and CG

CANARDS, TANDEM WINGS AND THREE-SURFACE DESIGN

(Continued from page 109)

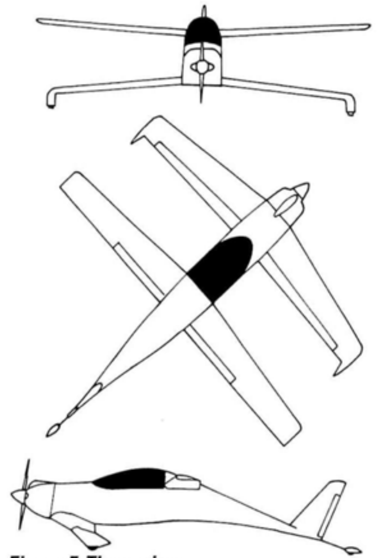


Figure 5. Three-view drawing of the Rutan Quickie.

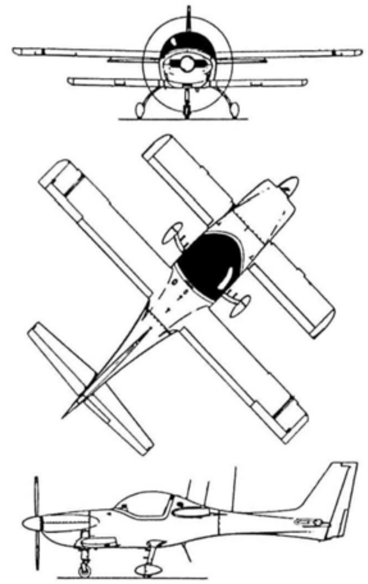


Figure 6. Roncz's Eagle three-surface trainer.

Tandem wings. This type has wings with close to equal area. The NP and CG are well forward. A pusher engine *behind the aft wing* would present an impossible CG problem.

Rutan's Quickie (Figure 5) illustrates a front-engine tandem-wing version, with its vertical tail mounted on an extension of the fuselage.

The Wasp (Figure 14, Part 1) is another version. The pusher engine is just behind the front wing. The aft wing and vertical surfaces were supported on booms. This model was very stable, but it had no flaps owing to its low wing loading.

Three-surface airplanes. The comments on wing sizing for a canard apply to the fore and main planes of the three-surface type. The presence of a horizontal tail causes both NP and CG to move rearward (compared with a canard). The tail's elevators provide pitch control. Slotted flaps on both fore and aft planes permit higher wing loadings with reasonable landing speeds.

Figure 6 shows John Roncz's "Eagle"—a successful trainer that proved safe and easy to fly. Its forward wing area is 67 percent of the main wing area, and both wings are equipped with slotted flaps.

Rutan's "Catbird" (Figure 7) is another three-surface design. Note the slight forward sweep of both canard and horizontal tail. The Piaggio P180 "Avanti" is a twin-pusher-engine, three-surface, slotted-flap airplane (Figure 8). The author's "Wild Goose" (see photo 9) was designed according to this three-part article and flies very well. All four illustrate the added flexibility offered by this three-surface configuration.

• **Aspect ratio and planform selection.** In addition to determining the areas of the wings, you must also select their aspect ratios and planforms as previously discussed.

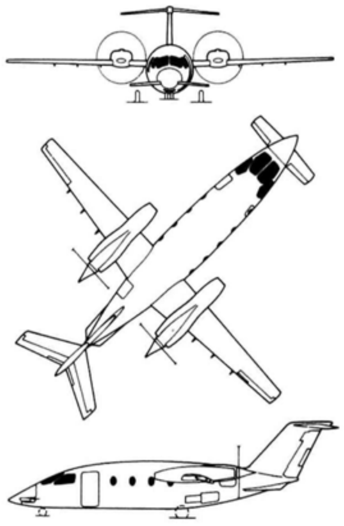


Figure 8. Piaggio P 180 Avanti three-surface twin.

• **Longitudinal and vertical separation.** Longitudinal separation (stagger) measured from the 25-percent-MAC points ranges from 1 to 3.25 times the aft wing's MAC.

Vertical separation (gap) should be ½ the aft wing's MAC as discussed.

Tail surfaces of a three-surface design should have a tail-moment arm as outlined in "Horizontal Tail Design, Part 1" (November 1993). A T-tail design is favored.

• **Airfoil selection.** As explained in Part 1, this is critical for stable flight. Additional information and formulas can be found in "Airfoil Selection," Parts 1 and 2 (May and June 1992).

The horizontal tail airfoil of a three-surface design should be of symmetrical section as described in "Horizontal Tail Design, Part 1" (November 1993).

Part 3 of this series will continue design approach and cover other factors. ■

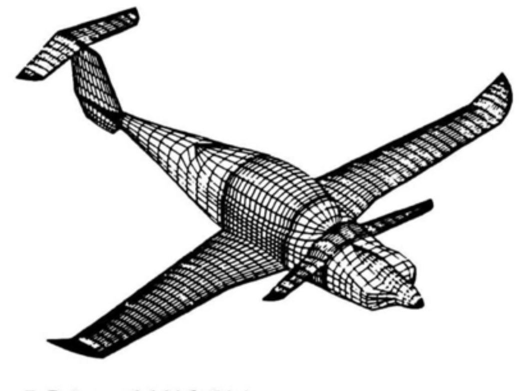


Figure 7. Rutan model 81 Catbird (VSAERO model); note three surfaces.

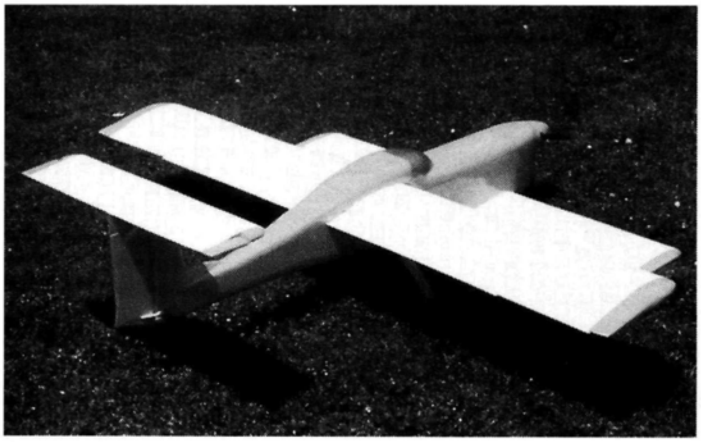
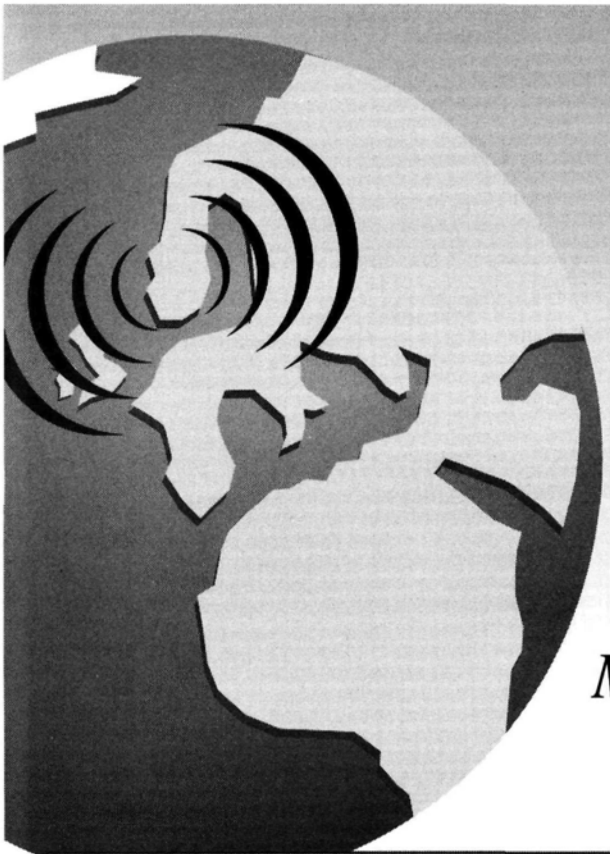


Photo 9. The Wild Goose, a successful three-surface design.

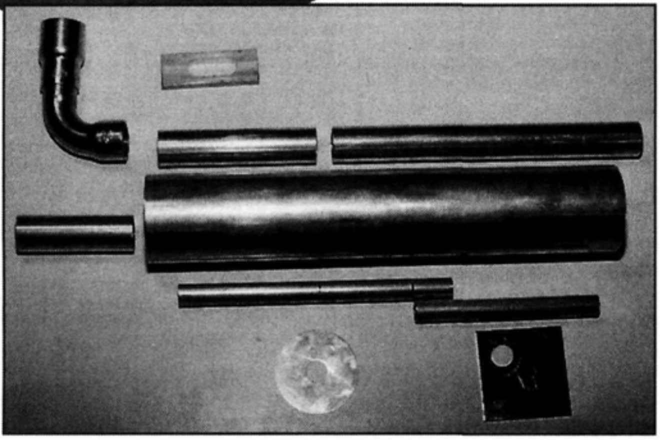


Sound Advice from Europe

PART TWO

More engine-quieting solutions

by TORE PAULSEN



All you need to make a TP muffler.

IN PART 1, I discussed engine noise in general, and I gave some formulas and muffler theory. I will now discuss the sources of noise, how to deal with it and how to make the hardware.

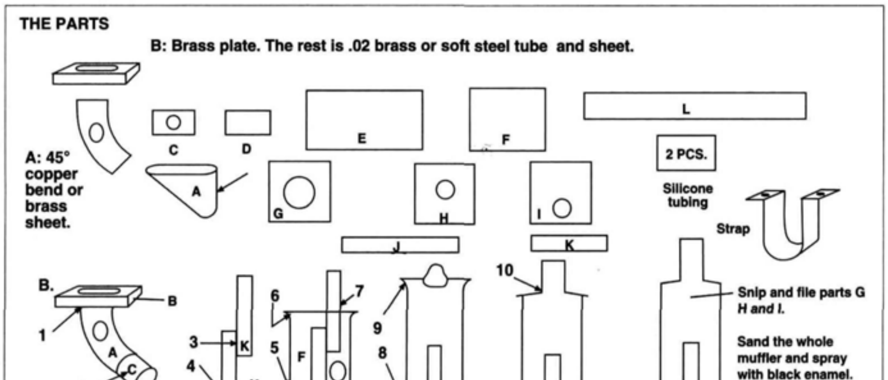
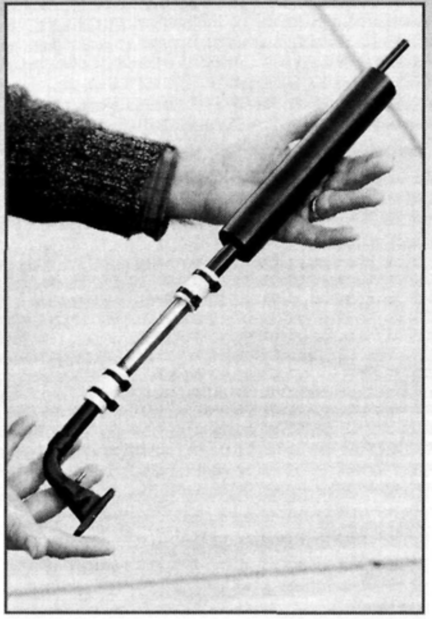


Figure 9. TP muffler: brazing sequence using silver solder.

HOW TO MAKE A TP MUFFLER

Use brass or soft-steel tube of a size close to the figures shown in the table in Figure 8 in Part 1. Cut the tube with a band saw or a Dremel cutting disk. The header is made of ¼-inch plate, shaped to fit the exhaust port. From a plumbing-supply shop, buy a 45-degree, thin-wall copper elbow that fits the connecting pipe, or make it according to Figure 9. Flatten it slightly where it meets the ¼-inch plate, and braze it on; then braze on a short pipe to the 45-degree bend.

An easy way to braze together the muffler pieces is shown at the bottom of Figure 9. For brazing, I use silver solder (which consists of 41 percent silver, plus cadmium, copper and zinc) and powder flux. First, the parts to be brazed have to be clean. Using a propane torch, heat the brazing rod and dip it into the flux; some of the flux will stick to the rod. Heat the part and touch it with the brazing rod. If the temperature is right, the rod will melt and flow around the joint. Wash off excess flux with hot water. When the parts have been joined, spray the assembly with a black, heat-resistant paint.



A completed muffler—painted and ready to install.

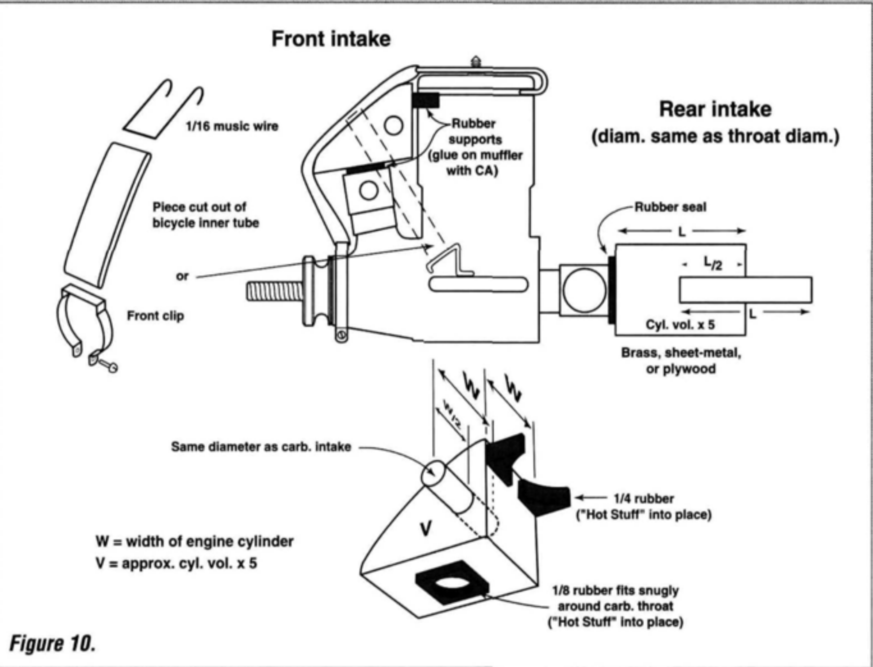


Figure 10.

After you've flown your model, there will always be a little oil in the muffler, so you should always store your models nose-up to avoid getting too much oil in the engine and making it hard to start. Because of the turbulence in the muffler, almost all of the oil comes out with the exhaust when the engine is running.

The muffler for a 4-stroke engine need be only a single-chamber pipe resonator. The small-diameter pipe and the pipe that goes into the chamber should be of the same diameter as the exhaust pipe supplied with the engine. If you think that making a muffler is too difficult or too much work, they are available in five sizes, in limited numbers, here in Norway. The complete system consists of gasket material, header, connecting pipe, muffler and silicone tubing. For more details, call or write to Asker Hobby, Kirkeveien 220, 1370 Asker, Norway; phone 47 66 90 2011 (shop), or 47 66 90 5555 (home); or phone me at 47 66 98 0153—any time.

• **Muffler rules.** To make this muffler work, you must follow a number of rules:

1. The first chamber's volume must be at least 10 times larger than the cylinder volume at 12,000rpm or lower; higher rpm require more volume.
2. The length of the second chamber must be equal to the length of the first multiplied by 0.666.
3. The internal pipes should be of the same length as the chamber, minus the mini-(header) pipe's diameter, multiplied by 0.4.
4. The internal pipes must be pushed exactly halfway into the chamber. This is important.
5. The different sections of the mini-pipe should fit tightly against one another.
6. The system must not have any leaks. To check for leaks, close the exhaust port, plug the pressure tap and blow into the outlet.
7. The connecting pipe should be of the correct length to tune the engine.

OTHER SOUND SOURCES

• **Sound from the carburetor.** This is caused by the sudden opening and closing of the intake port. The column of air going into the carburetor is frequently interrupted, and this creates a sound like an air siren. The sound's relationship to rpm does not appear to be linear.

I solved this problem by installing a simple pipe resonator (see Figure 10). The high dBA reading I got can be explained by the Webra Dynamix carburetor's plain venturi. A spraybar or a filter will lessen the sound. The best way to quiet the carb is to use a rear-intake engine; then, the forward part of the fuselage will be used as a muffler. Anyway, the trend is to use lower rpm, so that the carb makes less noise and muffling isn't necessary. You can get an idea of carburetor sound by removing the top cover of your auto's carburetor and driving around the block; your car will sound like an Indy 500 car.

• **Sound caused by engine/airframe vibration.** I once read that if you looked at your airplane's total area as a loudspeaker and your engine as the moving coil, a .60 engine at full rpm would emit sound at around 90 watts. I decided to investigate.

I mounted the engine with a number of strong rubber bands so that it could move freely in all directions. I then used a variable-frequency stroboscope to look at the engine while it was running. The vibration pattern looked like Figure 11. I tried different mountings with rubber instrument

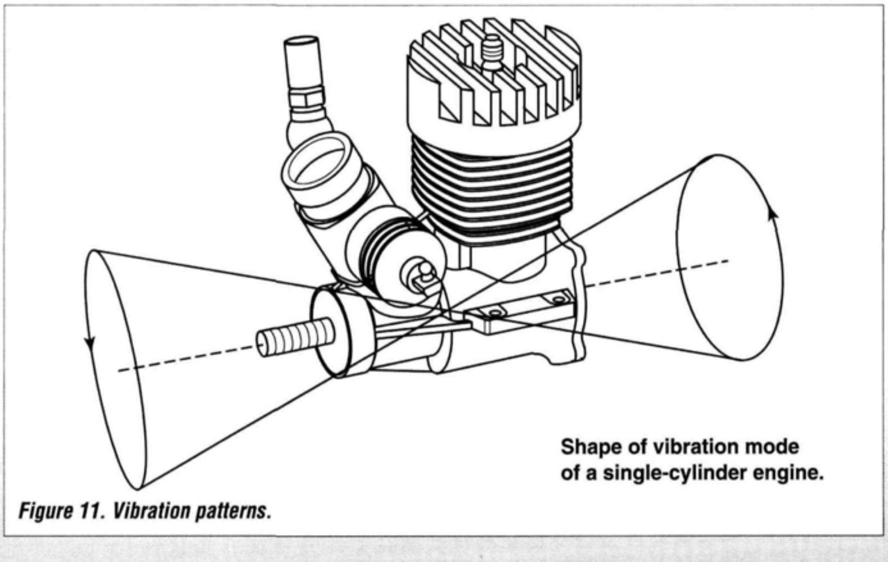
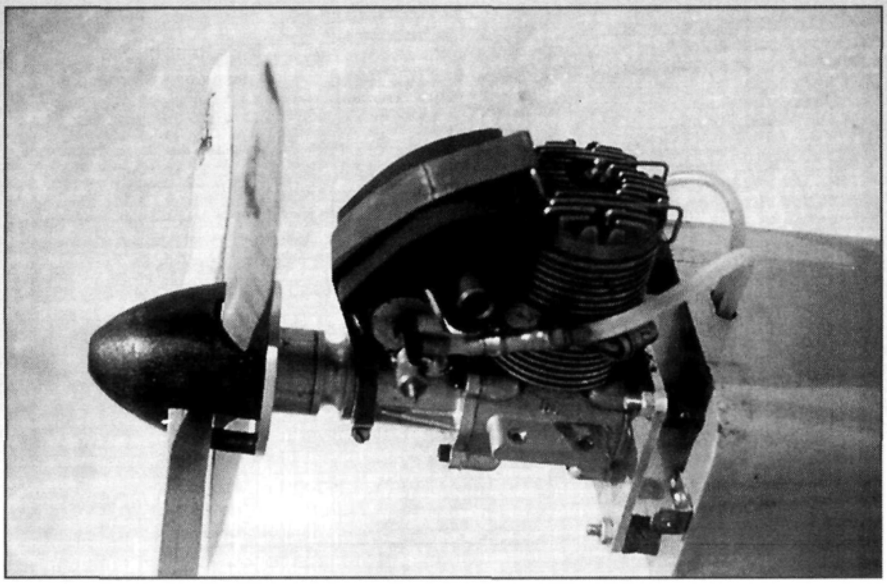


Figure 11. Vibration patterns.

ILLUSTRATIONS BY CHRIS MENDOLA



Ready to fly: a radial- and shock-mounted engine with ½-inch spacer between the prop and the thrust washer; muffled carburetor; multi-blade prop. The tuned pipe is on the rear.

dampers, and I found that a radial mounting transmitted less vibration to the fuselage than an axial mounting because it permitted the rear part of the engine to swing more freely. Full-size engines follow the same principle and use a dynafocal mount. The engine didn't vibrate much. At 10,000 to 12,000rpm, it was perfectly steady, but some vibration occurred at idle.

The soft mounts—both radial and axial—are shown in Figures 12 and 12A. The hardwood mounts can be drilled and threaded for the rubber dampers. Strengthen the threads with Zap (from Pacer Technology*), and you can then screw the dampers directly into the hardwood. The nuts on the engine side need not be tightened too hard. I have flown with soft mounts since 1977, and I've never had a nut come off. Do not use Loctite; you will just twist the damper off when you try to loosen the nut.

It is important that the mounts be soft enough to allow the shaft, held by two fingers, to be moved easily about ¼ inch in all directions—from side to side and up and down. Sullivan* mounts work well. I use 10mm-diameter, 10mm-long rubber instrument dampers with a threaded stud that has 4mm of threads showing at each end. The hardness should be between 40 and 60 shore.

Install the mounts symmetrically on the engine center line according to the vibration pattern shown in Figure 11. The distance between the dampers is not critical; Figure 12 shows the approximate distance. The softness test described above will show whether you have the right dimensions.

We have tried to soft-mount 4-strokers, but they shook everything apart, so more research should be done in this area. Use scrap foam and balsa in your airplane to help damp airframe noise. Also look out for rattling from bellcranks, wheel bearings and other parts. Support pushrods in the middle with foam bearings. I think fiberglass fuselages will be OK if the engine is soft-mounted and large, un-damped areas are supported with a bulkhead or glued to foam.

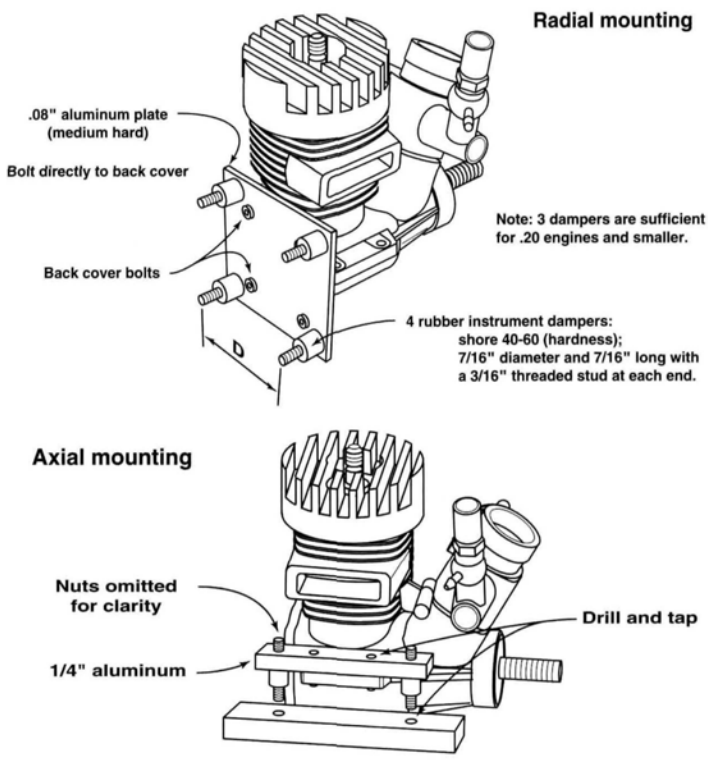
• **Sound from inside the engine.** This is already so low that little can be gained by cowling the engine, or taking any other action.

• **Propeller sound.** I've saved this till last, because it's the most difficult problem to solve.

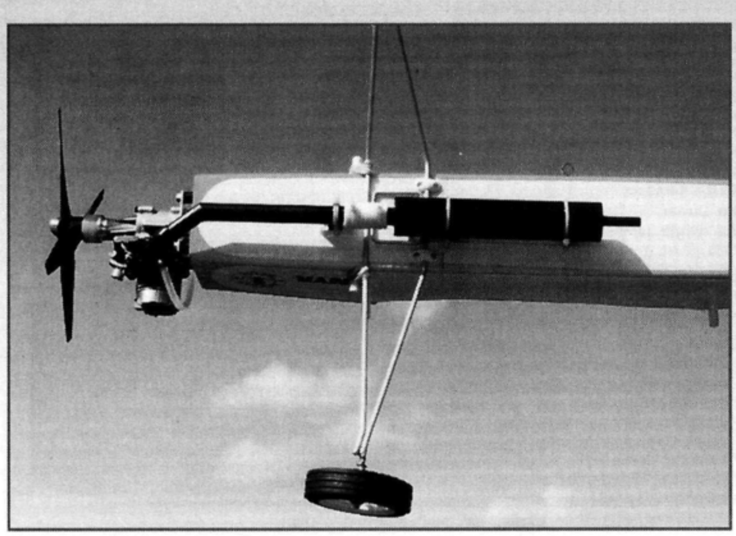
My first action was to find out how much sound came from the propeller; I ran a number of different propellers with an electric motor. The problem was that, at the high rpm needed, the electric motor was itself making too much noise, and this had to be deducted from the propeller sound, so obtaining accurate readings was difficult.

Luckily, my old friend, Jan David-Andersen who used to make excellent diesel engines, had made an electric machine that measures both thrust and horsepower at different rpm. The whole thing ran very quietly, so I used it to check my propeller sound readings.

The propeller sound graphs are shown in Figure 13. I tried in-flight sound measurement to compare it with the static readings, but it was too difficult to position the airplane in the exact position I needed for accurate readings. Subjectively, I can't hear much difference between static and in-flight sound. The sound is caused by the

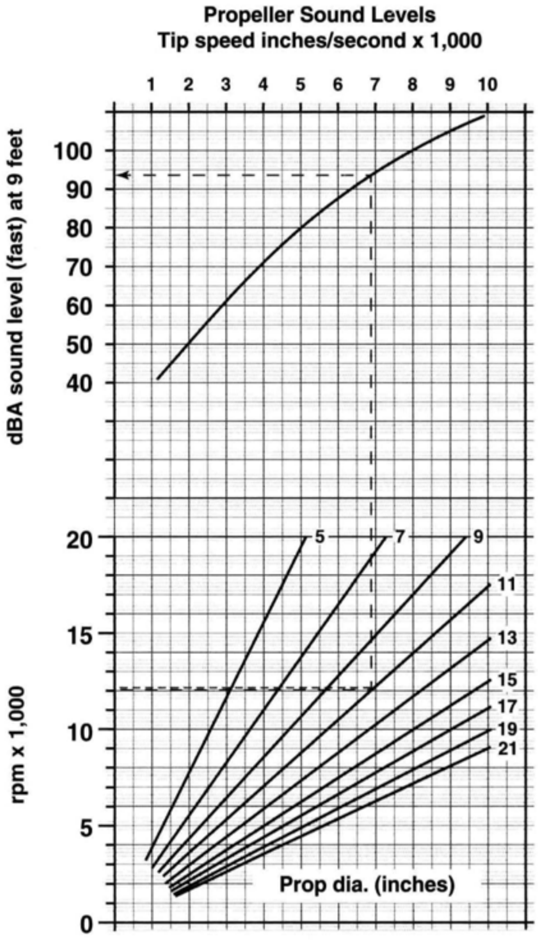


Figures 12 (top) and 12A.



A bottom view of a complete installation minus the carburetor muffler.

pressure difference across the propeller blade. As the propeller rotates, a pulse will be heard whenever a blade passes your line of hearing; these pulses will produce a tone. Sound is also produced by objects that are so close to the propeller that they disturb the pressure pattern; this is called the "near-field" effect. On all front-intake engines, the carburetor is always too close and causes this effect. If you install a ½-inch-thick spacer between the prop driver and the propeller, the sound level will drop by 3 to 5dBA. I have included Figure 15 to help you select a prop by comparing rpm and hp. In-flight rpm will increase by about 10 percent.



Average sound level from different propellers measured at 9 feet, 45° in front of propeller static.

Figure 13.

Ways to reduce propeller sound:

1. Reduce tip speed.
2. Avoid having objects, e.g., a cowl or a carburetor, close to the propeller; use a spacer (see Figure 14).
3. Use thicker blades (less important).
4. Use wider blades.
5. Use more blades.

I spent a summer testing the dynamic performance of propellers, but because of illness, my tests were limited. I will discuss the results generally, but in this area, there is room for much research. *Model Airplane News* has recently included articles about this problem, but I have chosen to look at it from a different angle; if anyone agrees with me, it would be nice if they would research them from this angle and publish the results as an extension to this article. I think it will require some computer power, because the dynamics involved will be complex. Let me discuss the factors mentioned in the list above.

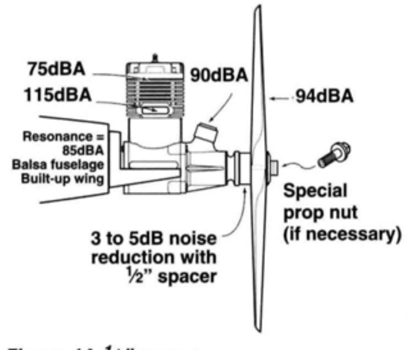


Figure 14. ½" spacer.

1. Tip speed can be reduced by reducing prop diameter and increasing pitch; however, I feel that the performance of a pattern or sport airplane will be judged by its vertical behavior, and an airplane with a small-diameter high-pitch prop will quickly lose speed and maneuverability when going vertical, in spite of its high initial speed.

Tip speed can also be reduced by increasing the prop's diameter and reducing rpm. Reduced rpm will reduce horsepower, but at one point in the airplane's speed range, it will gain thrust more than it loses horsepower, so speed and maneuverability will be maintained when flying vertical. If you also increase pitch, as is the current trend in pattern, propeller efficiency is quickly lost when slowing down. To find the best

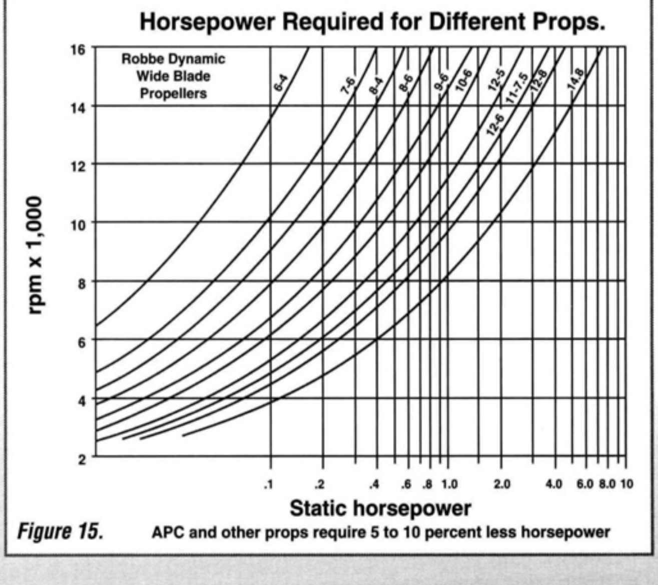


Figure 15. APC and other props require 5 to 10 percent less horsepower

combination of propeller, airplane and engine, both to minimize sound and maximize performance, there's still a lot of work to do.

2. The near-field effect can be avoided by positioning the propeller farther forward using the spacer as shown in Figure 14 or by using an engine with rear intake.

3 and 4. There are definitive differences among the sound levels from different propellers. I can't give you a list of brands, but a wide blade with a good airfoil section is best. APC* and Robbe* Dynamics are good.

5. As the number of prop blades is increased, the number of harmonic overtones is reduced, so there's less sound. Prop diameter must be reduced to maintain a reasonable rpm; but as diameter is reduced, efficiency is reduced, so a 4-blade propeller, which I tried, was not the solution, even if the sound was dramatically lower. Maybe it can be used on engines with high torque? Reference 2 (see end of article) describes prop problems in depth.

THE FUTURE

One thing is certain: either we reduce noise, or we do not fly. This article has dealt with how to reduce noise with present equipment, but I believe that we have to make radical changes to the airplane, engine and propeller combination.

The rule makers (the FAI and AMA) must avoid making rules that lead to the production of noisy airplanes, and/or they must limit noise emission gradually over a number of years, until a satisfactory low sound level—and a less irritating "sound picture"—has been reached. On behalf of the CIAM noise committee, I made a proposal to this effect at the CIAM plenary meeting in 1982, but it was not accepted.

The author works on the header assembly for a tuned pipe.

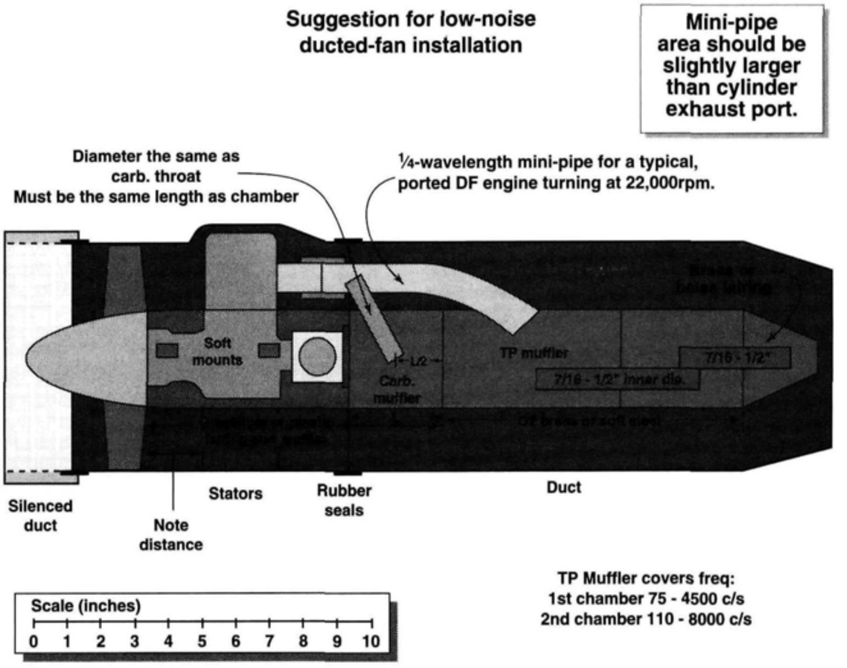


Figure 16.

Regarding engines, there has been little development of the 2-strokers, except for increasing rpm to increase power. At the beginning, 4-strokers were quiet, but as their power was increased, they became almost as noisy as the 2-strokes.

The same will happen to electric motors as power is increased. The motors themselves do not make noise, but the propellers do. What we need is an internal-combustion engine with good power at low rpm. A refinement of the diesel engine is one solution. The PAW* .49 R/C engine will pull a 14x8 at 6,750rpm, which will give prop noise of about 80dBA at 9 feet (see Figure 13) and 7.5 pounds of static thrust (see Figure 15). This is comparable to a high-revving .40, but with much lower noise emission.

I have always wondered why nobody, to my knowledge, has experimented with the uniflow scavenging of a 2-stroker. It consists of a number of bypass ports at BDC, and a mechanically operated exhaust valve in the head. The valve is operated directly from the crankshaft without gearing. It will give very high torque at low rpm, allowing it to pull large-diameter, multi-blade propellers. The propeller also needs some work, but I do not know enough about this subject to offer any solutions; I know, however, that the scimitar propellers of full-size non-ducted fans are that shape to reduce noise.

SILENCING DUCTED-FAN MODELS

I had not intended to write too much about ducted fans (DFs) or racing engines, but because of the high interest in them, I will share some ideas on this subject. I haven't done any practical experiments with DFs, so this is meant to be a basis for further work, both by the modelers and the manufacturers of these units.

First, the DF engine, which is usually of .91 size. I've stated that the first expansion chamber in a silencing system should have at least 10 times the cylinder volume at 12,000rpm to keep the backpressure and gas flow through the system within certain values. However, a DF engine runs at twice the rpm; consequently, the chamber should have 20 times the cylinder volume.

I made a DF muffler for Col. R. Thacker, but I forgot to take this into consideration and, of course, the muffler did not work (sorry, Robert!). Added to the problem of increased gas flow is that the gas is also released at higher pressure owing to the high exhaust port. The exhaust system must therefore be quite large and is difficult to fit inside the duct. I suggest a solution in Figure 16. In theory, a multi-blade DF should be much quieter than a two-blade, 5-inch-diameter propeller. At 22,000rpm, the propeller will emit 85dBA at 9 feet, but because the fan is multi-bladed, most of the harmonic overtones are canceled and the sound is much less—as long as there's nothing in close proximity to the fan's rotating pressure pattern. But that's just what we have!

Several stators, or flow straighteners, are positioned just behind the fan, and they act like an old-fashioned hand-cranked air siren as we know them from movies of WW II. Don't take my word for it; check Reference 2 (see below), which also states that, in addition, a shroud will halve the sound level and increase thrust.

The air-intake silencing—just like the full-size fans have—is mainly to reduce the interference sound from the stators. I estimate that the stators should be no closer to the fan than 1.5 to 2 inches. If this area is smooth and free, very little thrust should be lost. In Figure 16, I have made a sketch of how a ducted fan powered by a .72 engine turning 22,000rpm should look. The fan itself is now pretty well optimized, so I will leave it as it is.

I hope this will get somebody started on making a ducted fan from which only the rush of air is heard! From Norway, I send best regards to all fellow model airplane enthusiasts.

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3. P. Fücker. *"Lärm-Lärm—Reflexions Schall Dampung Mittel Reihen-Resonator."*

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**Addresses are listed alphabetically in the Index of Manufacturers on page 146.* ■

CLUB OF THE MONTH

FAIRFIELD LEAGUE OF YANKEE RADIO CONTROLLERS (FLYRC)

P.O. Box 3616 Danbury, CT 06810

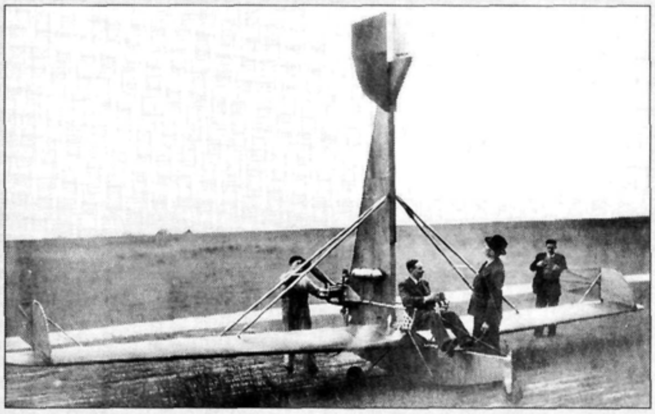
In the August issue of Danbury, CT-based Fairfield League of Yankee Radio Controllers' (FLYRC) monthly newsletter—The Fly Paper—it states, "Please try to make the next meeting; something wonderful will be discussed!" The something wonderful was the possibility of a second flying field for the club to use. FLYRC currently uses a very well-maintained site at Mitchell's Farm in Southbury, CT. To keep the landowners and neighbors happy—with regard to noise—the club has limited its membership to 50. A new field would help the club's growth by allowing 35 people who are on the waiting list to start flying. Another noise-control effort is FLYRC's adherence to a 93dB rule for models; members test new engines and mufflers to find quieter combinations *before* noise becomes a problem.

FLYRC is involved with a lot of public-relations work and, to keep the roots of modeling alive, the club hosts an annual Cub Scout Fly Day at the field and has established a junior-member program. Many members, including Bob Gilbert, Ken DeFusco, Jay Weiner, Kevin Siemonsen and "Simple Programming" columnist Dave Baron, have also contributed to *Model Airplane News*. For their public involvement, continuing sound-reduction program and their concern with junior-member development, FLYRC has been chosen as this month's Club of the Month. ■

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



CONGRATULATIONS to Frank W. Beatty of Granite City, IL, for correctly identifying the September '95 mystery plane. The Focke-Wulf F-19a "Ente" (Duck)

was a twin-engine, canard, monoplane flown in the early '30s that carried three passengers in the cabin and a pilot in the front open cockpit. The plane was made of plywood, steel tubes and fabric. Its high-wing, cantilever main wing was mounted toward the rear and had a slight dihedral, and it was tapered in both planform and thickness. The forward canard was trapezoidal in planform and also supplied lift. Its main wingspan was 32 feet, 10 inches, and the forward wingspan was 16 feet, 5 inches. The 34-foot-, 7-inch-long plane was powered by two 110hp Siemens Sh. 14 7-cylinder radial air-cooled engines. Its empty weight was 2,850 pounds, with a useful load of 1,050 pounds. With a maximum speed of 89mph and a cruising speed of 79mph, it could climb to 3,280 feet in 8.3 minutes—its landing speed was 52mph.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News.* If already a subscriber, the winner will receive a free one-year extension of his subscription.

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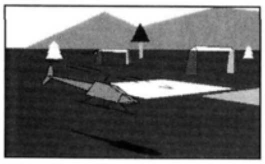
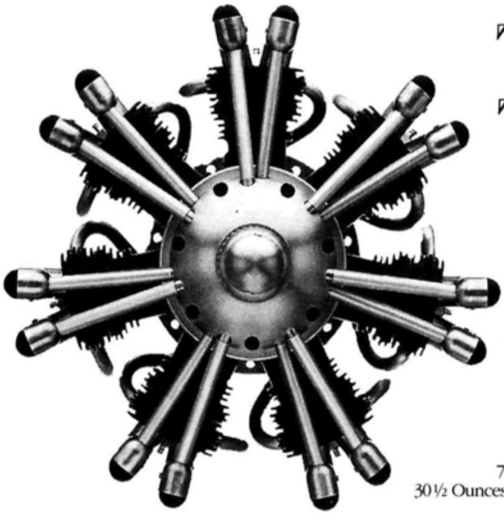
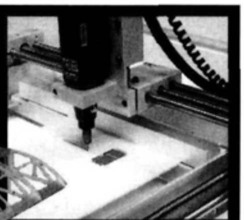






PRODUCT NEWS

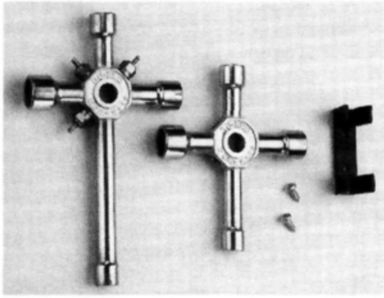
HOUSE OF BALSA INC.

A7 Corsair II

This all-balsa and plywood kit comes with full-size rolled plans, a photo-illustrated instruction manual, scale 3-view documentation, Du-Bro hardware and a full set of dry-transfer decals. Specifications: wingspan—39 inches; wing area—345 square inches; weight (with standard radio)—3½ pounds; fuselage length—37¼ inches; engine required—.25; radio required—4-channel.

Kit no.—K-35; **price**—$69.95.

House of Balsa Inc., 10101 Yucca Rd., Adelanto, CA 92301; (619) 246-6462; fax (800) 249-8003.



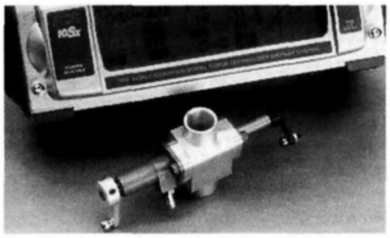
DU-BRO PRODUCTS INC.

4-Way Socket Wrench

This wrench will accommodate both American- and metric-size sockets and has three built-in glow-plug holders. It also has a special glow-plug retaining clip for easy installation and removal. So that you can mount it to your field box, it also has a Storage Klip and mounting screws.

Part nos.—701 (standard size), 702 (XL); **prices**—$5.95, $6.95.

Du-Bro Products Inc., 480 Bonner Rd., P.O. Box 815, Wauconda, IL 60084; (708) 526-2136; fax (708) 526-1604.



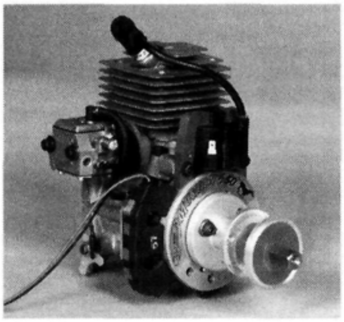
HORIZON HOBBY DISTRIBUTORS

JR TEC-1000 Carburetor

Use this carb with JR's PCM-10SX heli radio to completely adjust mixture settings at all throttle positions. It allows you to select a rich mid-range for smooth hovering, a leaner mid-range for stunt flying and a rich setting for autorotations. The carb body is CNC-machined of bar-stock aluminum and has a hard-anodized throttle barrel with a 10mm bore. It also comes with sleeves so that it can be adapted to most popular .61-size heli engines.

Part no.—JRPA500; **price**—$219.95.

Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511; fax (217) 355-8734.



BYRON ORIGINALS

Mustang 50 Engine With Magna Charge

The new Byron Mustang 50 engine is now available with Magna Charge—an electromagnetic system (there are no moving parts to wear out) that doesn't rob the engine of power. This unique second coil can charge your receiver battery pack as well as a second transmitter pack (on board). The charger option weighs only 5 ounces, and it doesn't cause radio interference when it has been properly installed.

Byron Originals, P.O. Box 279, Ida Grove, IA 51445; (712) 364-3165; fax (712) 364-3901.

SULLIVAN PRODUCTS

Wheel-Pant Mounts

Designed to fit standard 5/32-inch axles and music wire, these rugged steel wheel-pant mounts are easy to install and adjust. They also eliminate the need for wheel collars.

Part no.—888.

Sullivan Products, P.O. Box 5166, Baltimore, MD 21224.

KYOSHO

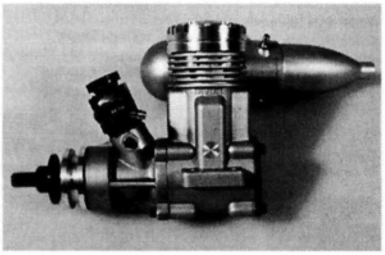
Personal Band Monitor

This unique audio and LED alarm system alerts pilots to frequency interference. Three red LEDs show the proximity of the interference: one LED means that someone within 2,600 to 4,900 feet is on the same frequency; two LEDs—1,600 to 2,600 feet; three LEDs—1,600 feet or less. Available on 72MHz, the Personal Band Monitor will recognize AM, FM and PCM wavelengths, both narrow and wide band. It requires four AA batteries and crystals (accepts Futaba FM receiver crystals).

Part nos.—KYOP0200 (monitor), FUTL20 (dual-conversion FM crystal set); **prices**—$89.99, $34.95.

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104.

Product News



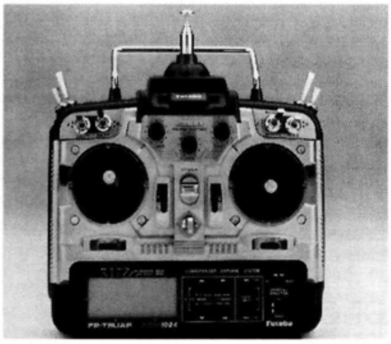
ALTECH MARKETING

Irvine .46 ABC Engine

The Irvine .46 side-exhaust engine comes with a silencer and has a sealed front bearing, revised porting and gas passages and a Jetstream carburetor. Dual ball bearings and CNC-machined components ensure its longevity.

Part no.—IR1464; **price**—$174.98.

Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.



FUTABA CORP. OF AMERICA

FP-8UAP PCM 1024

Futaba's 8 Series system has eight-model memory, six-character model name entry, five mixing circuits with "P" mix and multi-function mix, auto trim memory, trim rate and engine cut. Its sailplane menu offers throttle exponential, butterfly, elevon, start and speed mixing; throttle needle, swash mode and three-circuit revo mix are available in the heli mode. The system includes a narrow-band receiver, four ball-bearing servos, transmitter and receiver Ni-Cd batteries, a charger, a switch harness and hardware. Available on 50 or 72MHz.

Futaba Corp. of America, P.O. Box 19767, Irvine, CA 92713-9767; (714) 455-9888; fax (714) 455-9899.

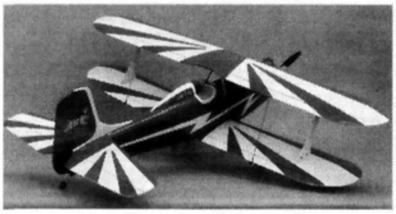
TOWER HOBBIES

Tower Trainer 60

Specifications: wingspan—69.5 inches; wing area—877 square inches; weight—7.5 to 8.5 pounds; engine required—.35 to .46 2-stroke; radio required—4-channel (with four servos).

Part no.—TOWA1010; **price**—$139.99.

Tower Hobbies, P.O. Box 9078, Champaign, IL 61826-9078; (800) 637-4989; fax (800) 637-7303.



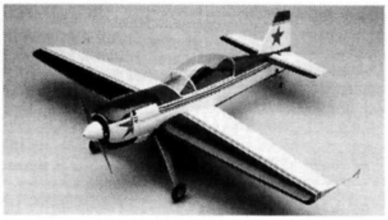
SIG MFG. CO. INC.

Hog-Bipe

This kit features a simple lite-ply fuselage and balsa-ribbed wings and comes with laser-cut parts, photo-illustrated instructions, full-size CAD plans, bent aluminum landing gear and cabane struts, molded ABS plastic headrest and wheel pants, glass-filled engine mounts, Sig Easy Hinges, pushrods and a complete hardware package. Specifications: wingspan—54.5 inches (top), 51.75 inches (bottom); total wing area—966 square inches; length—50 inches; weight—6.5 to 7.5 pounds; engine required—.60 to .65 2-stroke or .65 to .90 4-stroke.

Kit no.—RC-69.

Sig Mfg. Co. Inc., 401-7 S. Front St., Montezuma, IA 50171-9900; to order: (800) 247-5008; inquiries: (515) 623-5154; fax (515) 623-3922.



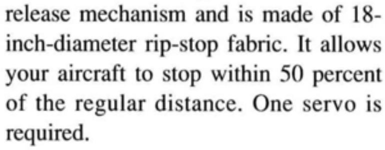
MODEL TECH

Sukhoi 60

This built-up, hand-crafted model has been hand-sanded and comes virtually ready for finishing and covering. Wing construction is full balsa sheeting over balsa ribs, and the fuselage and tail are also made of balsa. The kit includes a molded fiberglass cowl and separate fiberglass belly pan/wing cover, landing gear, a molded clear canopy, instructions and a hardware package. Specifications: length—48 inches; wingspan—61 inches; wing area—644 square inches; engine required—.60 to .90 2-stroke or .90 to 1.20 4-stroke; radio required—4-channel (with five servos).

Kit no.—123690; **price—**$340.

Model Tech; distributed by Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.



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Price—$15.95 each.

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MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952; "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C. Canada V0R 1L1. [2/96]

DEBOLT PLANS: radio control; free flight; control line. Separate SASE for each list to: Fran Ptaszkiewicz, 23 Marlee Dr., Tonawanda, NY 14150-4321. [3/96]

COLLECTION FOR SALE: Over 350 kits from 40's, 50's, 60's, F/F, R/C, U/C, Rubber, Solids, Jetex. Send SASE ($.55) to Dr. Frank Iacobellis, 62 Palisade Rd., Rye, NY 10580, or call (914) 967-5550. [1/96]

PAYING $50 TO $125 each for following toy metal outboard boat motors: Gale, Oliver, Sea Fury, single and twin Johnson, Mercury, etc. Also want thimble drone metal racecars. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686; (616) 941-2111. [5/96]

MODEL MOTORS WANTED: most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [12/95]

WANTED: Cox, Wen-Mac, Testors, etc. Gas-powered plastic cars, planes, boats. Please call or write. Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [4/96]

PLANS: Flying Flea Plans (full size): HM-14 $35, HM-16 $125, Pouplume $75, Newsletter $15. Archive, Box 892, Wooster, OH 44691. [12/95]

SLOT CARS WANTED: Cox, Aurora, Tyco, etc. 1960's, 1970's vintage; any scale. Please call or write. Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [4/96]

WANTED: 12-inch G.I. Joe and Captain Action. Jeff Gilbert, 423 S. Randolph St., Princeton, IL 61356-1960. [3/96]

P-38 LIGHTNING—LOVE IT? Join a group of P-38 modeling and full-size enthusiasts. Share modeling, flying, historic facts and articles about the P-38. Entering fee of $15 covers newsletters and club patch. For more information, write: P-38 M.O.I. Ron Parker, 3003 Windchase, #1003, Houston, TX 77082-3444. [4/96]

ANTIQUE MAGAZINES: Complete private collection. Bill Barnes Pulps, Air Trails, Flying Aces, others, $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3. [3/96]

WANT TO BUY: Cox .35 and .40 engines. Thanks. Please write Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [3/96]

WANTED: Futaba single-stick helicopter radio, whole system or transmitter only. Robert (814) 825-8404. [2/96]

HUGE TOWPLANE—will tow the largest sailplanes. ⅓ L5 with Saks 8.4 twin and Futaba servos. Mint condition. $2,500.00; ⅓ Christen Eagle, NIB—$350. Contact Robin Lehman (212) 744-0405. [1/96]

SALE—Getting out of the hobby. All finished airplanes, support equipment, miscellaneous tools and parts. For listing, send #10 SASE to G. Hunicke, 18 Media Dr., St. Louis, MO 63146. [1/96]

INTERESTED IN OLDER SCALE airplane balsa kits, Cleveland plans, and wood kits of race cars. Good used engines, building supplies/material, radio control accessories, etc., are also of interest. Please list condition and best price. I will buy one piece or entire collection. Randy Christensen, 1113 Balboa, Denison, TX 75020. [2/96]

FOR SALE: K&B .61 R/C engine with carb and muffler and bolts. New motor, never been run. Still in original box. Paid $150; sell for $80. Please call or write (817) 699-1274. Ronald Kilgore, 1103 Park Hill Dr., Killeen, TX 76543. [1/96]

WANTED: Model engines and racecars before 1956. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [12/95]

FOR SALE: Used Saito 270 Twin $400. Contact Robin Lehman, 63 East 82nd St., New York, NY 10028; (212) 744-0405. [12/95]

EVENTS

LARGEST SWAPMEET AND AUCTION IN ILLINOIS! 140 tables. Hosted by the Tri-Village RCer's on Saturday, February 3rd, 1996, at the DuPage County Fairgrounds, Wheaton, Illinois. Vendor set-up at 8:30 a.m. General admission at 10:00 a.m. Dedicated selling hours: 10 a.m. - 3:30 p.m. FREE Auction at 4 p.m. FREE parking, hot food, door prizes, raffle and more. Reserve tables early—last year's show was a blow-out! Multiple table discount. Call John at (708) 837-1343 or Jim at (708) 439-6922 to reserve tables or obtain flyer. [2/96]

FINAL APPROACH

R/C TILTWING PROGRESS

Mark Scott of Hamden, CT—a master modeler, Sikorsky engineer and member of the Winding Brook and East Coast Swamp Fliers R/C Clubs—is pioneering the development of an extraordinary tiltwing R/C aircraft. As many will recall, we earlier published a photo of Mark Scott's tiltwing design in full hover (see Chris Chianelli's "Air Scoop" column in our October '94 issue). Mark has since flown the airplane in conventional horizontal flight and in short takeoff and landing (STOL) mode with the wing tilted 15 degrees. He has yet to transition between hover and horizontal flight, but prospects look promising.

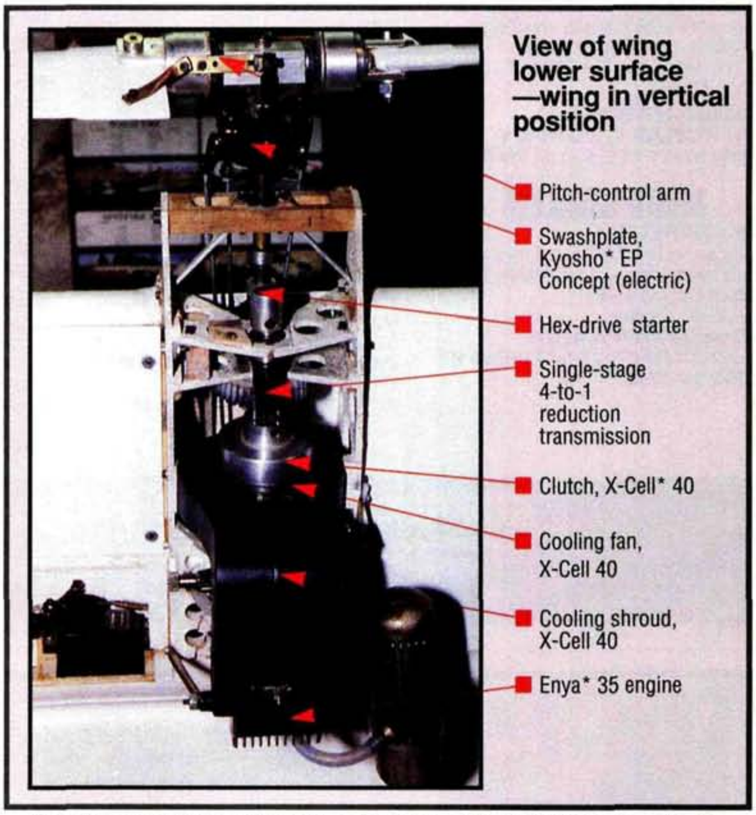
Mark's first tiltwing design (shown here) has a 63.5-inch span, a 775-square-inch wing, is 57 inches long and is propelled by 27-inch-diameter propellers (also called proprotors, because they're variable-pitch rotors doubling as propellers). Mixing will be performed electronically via a commercially available chip programmed through a PC. The transmission consists of engines, clutches and gears on each wing half connected by a 0.25-inch cross-shaft. He believes he can make the system much simpler by mounting the engines inboard and driving the proprotors with belts (his winter '95/'96 project). Inboard engines will considerably reduce drag as well as roll and yaw inertia. This second iteration design (see 3-view) will have detachable wingtips and, like the current version, a detachable horizontal tail for easy transportation.

The two-engine configuration permits a safe landing if one engine fails at low altitude. Mark has agreed to consider publishing the details of his finished design in *Model Airplane News*. He is also contemplating a simpler, STOL version that can be flown using available programmable radios, i.e., without the programmable chip. We'll keep you posted!

—Tom Atwood

Designer Mark Scott runs up the Enya 35 heli engines with the wing at a 15-degree tilt.

The tiltwing flies using Mark's original configuration in which blade pitch travel is a function of throttle. Experimentation using an electronic governor to regulate proper rpm by varying blade pitch has not panned out yet. He reports that takeoff speed and flight characteristics are much like those of a trainer despite the craft's 13-pound weight. "This is because the proprotors are generating considerable lift and blowing high-velocity air over the wing at a 15-degree wing tilt. With the wing full down, control response was much like any other airplane of its size and weight."



Note the clever engineering of the propulsion system on Mark Scott's tiltwing.

IMPROVED TILTWING SPECIFICATIONS

Wingspan: 70 in.
Wing area: 775 sq. in.
Length: 58 in.
Propeller (proprotor) dia: 27 in.
Flying weight: 12 to 13 lb.
Wing loading: 35.6 to 38.6 oz./sq. ft.
Power: two .40 to .50ci glow engines